BLUE JAY

September 1998

Blue Jay, founded in 1942 by Isabel M. Priestly, is a journal of natural history and conservation for Saskatchewan and adjacent regions. It is published quarterly by **Nature Saskatchewan, 206-1860 Lorne Street, Regina, Saskatchewan, S4P 2L7.**

CN ISSN 0006-5099.

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Cover: American White Pelicans at Gardiner Dam, by Ralph Grose.

Published by the Administration Centre Printing Department. Printed in Regina, Saskatchewan on 10% recycled paper.
THIS ORGANIZATION RECEIVES FUNDING FROM

Saskatchewan LOTTERIES

Blue Jay

Vol. 56 No. 3 September 1998 137-200

EDITOR'S MESSAGE

My appeal for new Associate Editors was successful. Robert G. Warnock (University of Saskatchewan) and R. Mark Brigham (University of Regina) both volunteered their services. I welcome them aboard and look forward to working with them in the future. Two of the original Associate editors would like to retire, so this works out well.

I would appreciate authors using the following guidelines when preparing an article. I particularly request that you avoid using format codes in electronic submissions.

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The article should start hard against the left margin. Please do not use indents, tabs, centres, pagination or any other format code. There is no problem with using **bold,** underline or *italics* within the text.
The scientific names of species should be in *italics* (e.g., *Buteo swainsoni*).
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Tables should be sent as hard copy or as a separate file.
Authors are asked to limit their references to 10 or less.
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For example,

2. FINLEY, K. 1996. The Red Fox invasion and other changes in wildlife populations in west central Saskatchewan since the 1960s. *Blue Jay* 54:206-210.

These guidelines will be referenced on the front cover of all subsequent issues, along with editorial policy (*Blue Jay* 54: 174-175).

In the last issue the article on the Summer Tanager At Valeport by Ferne Lawren should have read "Lois Gibson saw the the shape of the bird *and* the dark shading"
Sincerely,

Roy D. John

POPULATION SIZE AND PRODUCTIVITY OF PIPING PLOVERS AT LAKE DIEFENBAKER IN RELATION TO WATER LEVEL.

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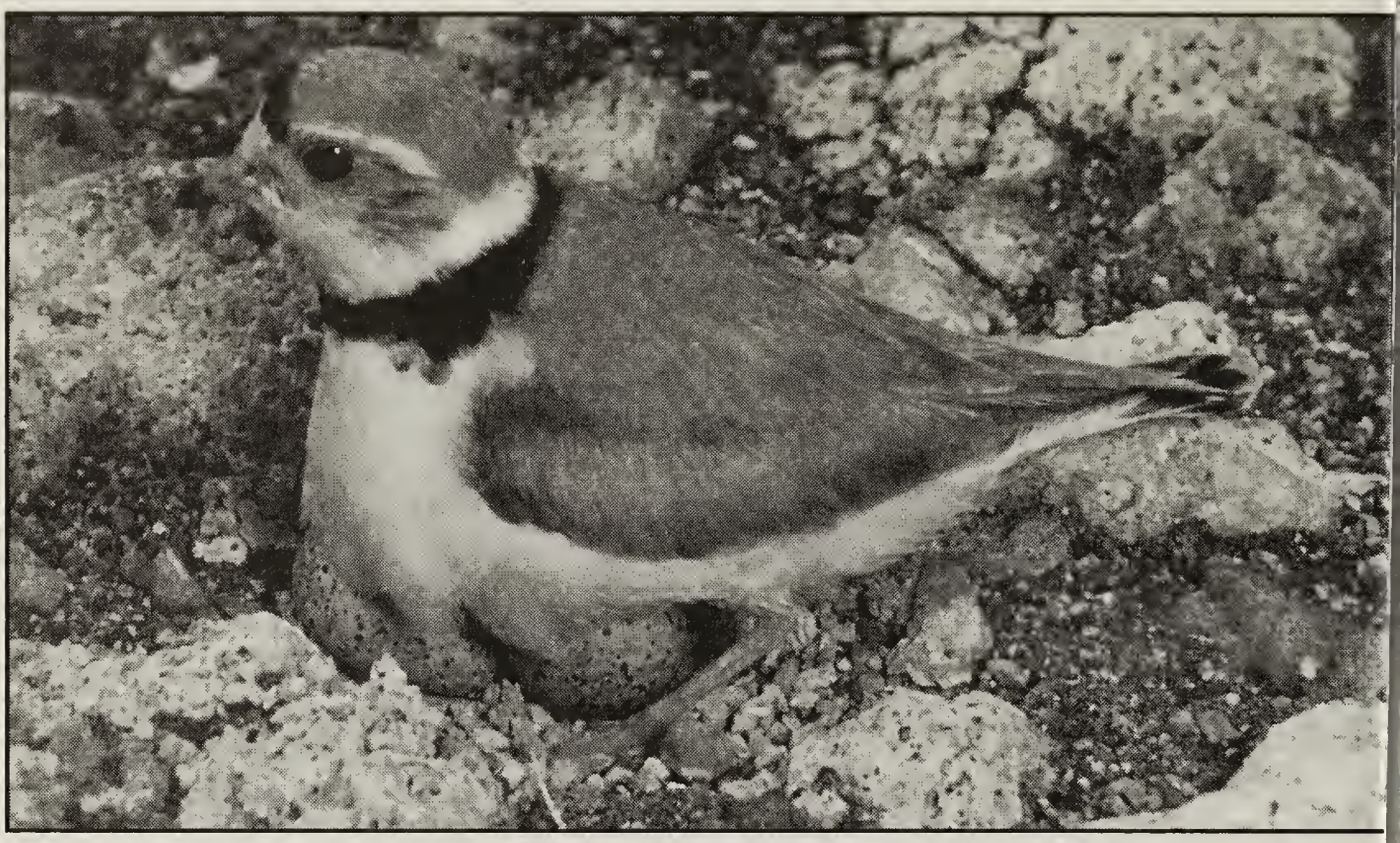
In the breeding season Lake Diefenbaker is home to a significant, although varying, portion of the world Piping Plover population. This presents reproductive challenges to the Piping Plover, an endangered species, because water level in this huge reservoir often rises from 2-6 m between early May and late July, the plover's breeding period. There is growing concern among conservationists that reproductive losses due to flooding of nests and disappearance of brood-rearing habitat under flooded beaches may be hindering recovery efforts of this species. A simulation model developed to assess the effects of flooding on Piping Plover reproductive success at Lake Diefenbaker over the last 30 years suggests that flooding of nests and chick-rearing habitat has had a detrimental effect on productivity[3]. By attracting large numbers of breeding plovers to its beaches in some years, with subsequent high reproductive losses due to rising water level, Lake Diefenbaker may be a "sink" rather than a "source" for the plover population.

The 1991 and 1996 international Piping Plover censuses suggested that 64% and 60%, respectively, of the Canadian population of breeding Piping Plovers occurred in Saskatchewan.[18 19] This represents 23% and 21%, respectively, of the total North American population. Within Saskatchewan, Lake Diefenbaker was identified as a particularly important breeding area for Piping Plovers in some years. In 1991, 24% of the Saskatchewan population bred there, representing about 5% of the world population. However, only 6% of the Saskatchewan population bred there in 1996. Piping Plovers move from year to year in response to changing water regimes. We summarize data from various studies from 1984 to 1996 on population size, distribution, productivity, and other reproductive variables of Piping Plovers at Lake Diefenbaker. The data is standardized and presented in a uniform format in order to make comparisons among years. This summary strongly suggests that Piping Plovers are often not faring well in their reproductive efforts due to changing water level at Lake Diefenbaker. Further stud-



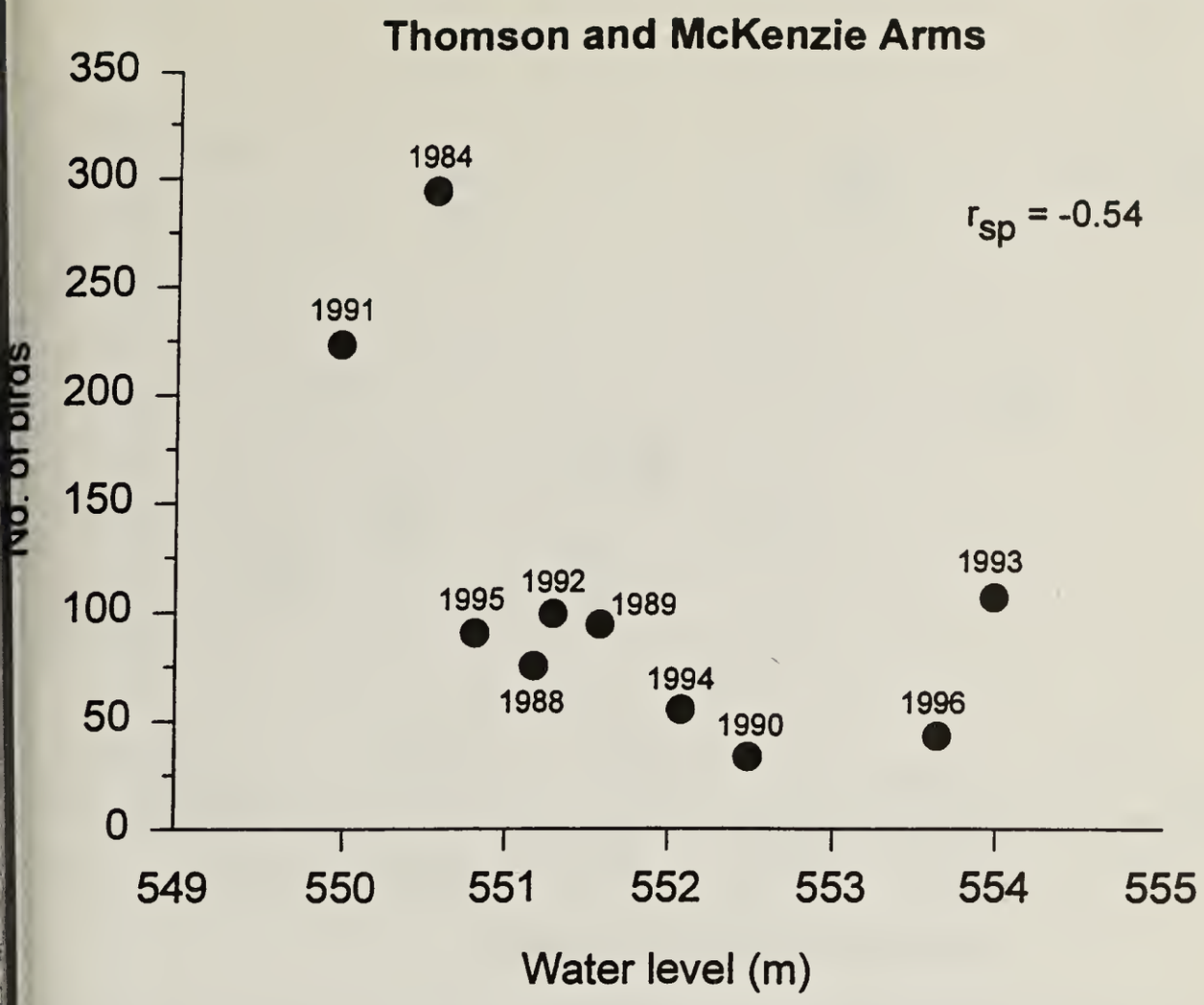
Piping Plover *Ian W. Sadle*

ies will clarify potential management actions that may enhance the Piping Plovers' productivity in some years at this site.

Population Studies Lake Diefenbaker was confirmed as an important basin to breeding Piping Plovers in 1984 when the first census was conducted there[10]. Survey data from 1984 to 1996 indicates that numbers of plovers using the reservoir is highly variable from year to year (Table 1).

A complete census occurred in only 4 of the 10 years for which population counts were conducted between the end of May and the first half of June: in 1988, 1991, 1992 and 1996. Most of the shoreline with suitable habitat was censused in the other years except for 1993, when only 5 small, but important, study sites were monitored[2]. In order to have the population survey information comparable among years, a population estimate was calculated for the years of incomplete censuses[17]. The estimates were determined as follows (except for 1993): for portions of the shoreline that were not censused in a given year, the average number of birds counted in those portions was calculated from years when the overall population count was similar to the year in question. This estimate was added to the actual count from the censused portions of the lake for that year. For 1993, the estimate was determined using the 1992 sites as an index of the total population: the 3 sites had on average, 40.7% of the total population in 3 years of complete counts (1991, 1992, and 1996)[1]. The 1993 count at the 3 sites was assumed to be 40.7% of the total population. Population distribution and shoreline areas censused in each year were also mapped[17].

One question about population fluctuations that arises is: why are numbers so variable among years? One hypothesis speculates that years of high population numbers may occur in years when water levels are low, and thus exposed beaches are wider, at the time plovers are arriving. To examine this idea, the population counts for years of complete censuses and the estimated populations for years of incomplete censuses were compared to the water level in the reservoir on May 12 of that year (Figure 1



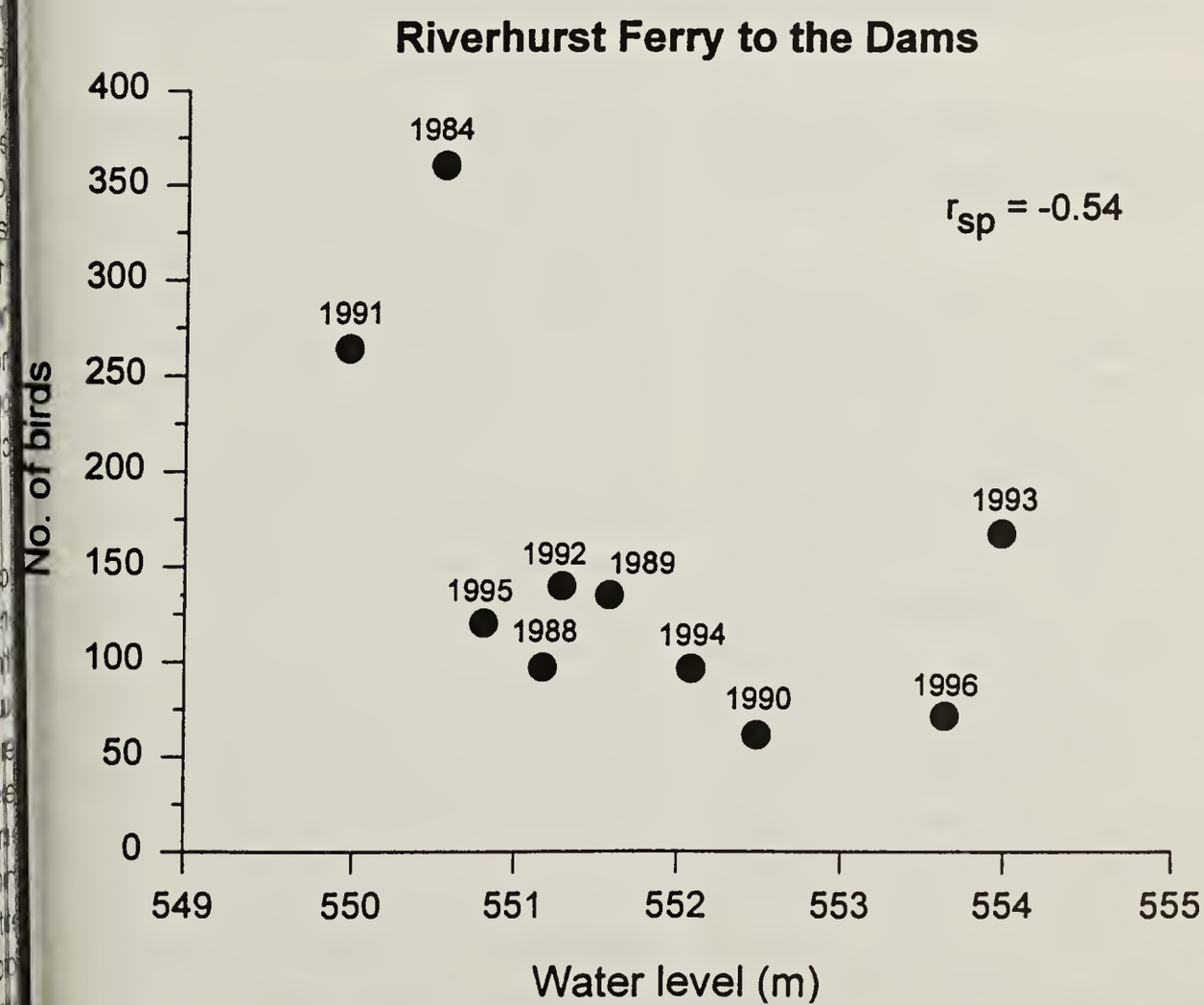


Figure 1. Number of Piping Plovers at Lake Diefenbaker versus May 12 water level

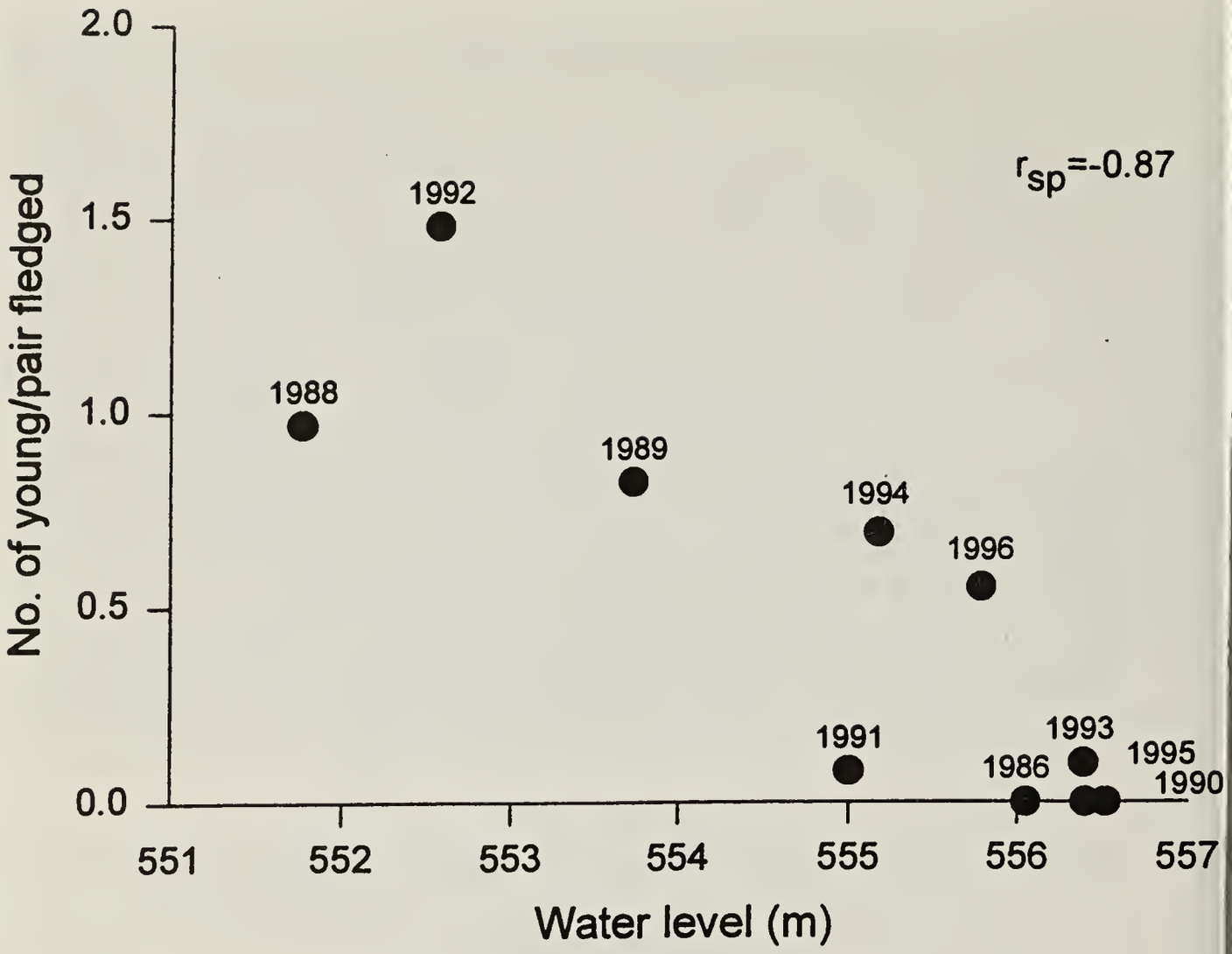


Figure 2. Fledging rate of Piping Plovers at Lake Diefenbaker versus July 1 wate levels.

May 12 was used because it is the mean initiation date for Piping Plover nests at Lake Diefenbaker (Table 2).

A relationship between May 12 water level and the number of plovers inhabiting Lake Diefenbaker is apparent (Figure 1). At water levels below 550.8 m (above sea level), the number of plovers increases to high levels. In 1993, the estimated population appears slightly anomalous being somewhat higher than expected with a May 12 water level of 554.0 m. The population estimate for 1993 will be less reliable than that of other years for 2 reasons. First, this was the year when the least amount of shoreline was actually censused and thus the greatest extrapolation was required. Second, the estimate is based on more thorough and numerous counts than the typical count and therefore may be higher.

An alternative hypothesis to the ques tion of why numbers are so variable among years is that years of high popu lation numbers may follow years of high fledging success because birds may return to areas where they successfully bred at higher rates than unsuccessfu breeders, and young may also home This hypothesis predicts that years o high productivity would be followed by years of higher populations. A cursory comparison between the number o plovers in one year, and the fledging success the previous year strongly sug gests that no relationship exists betwee these two parameters. Hence the pro ductivity hypothesis is rejected.

The apparent relationship betwee population level and May water level i the reservoir suggests some possibl water management options. Becaus rapidly rising water level in June and th

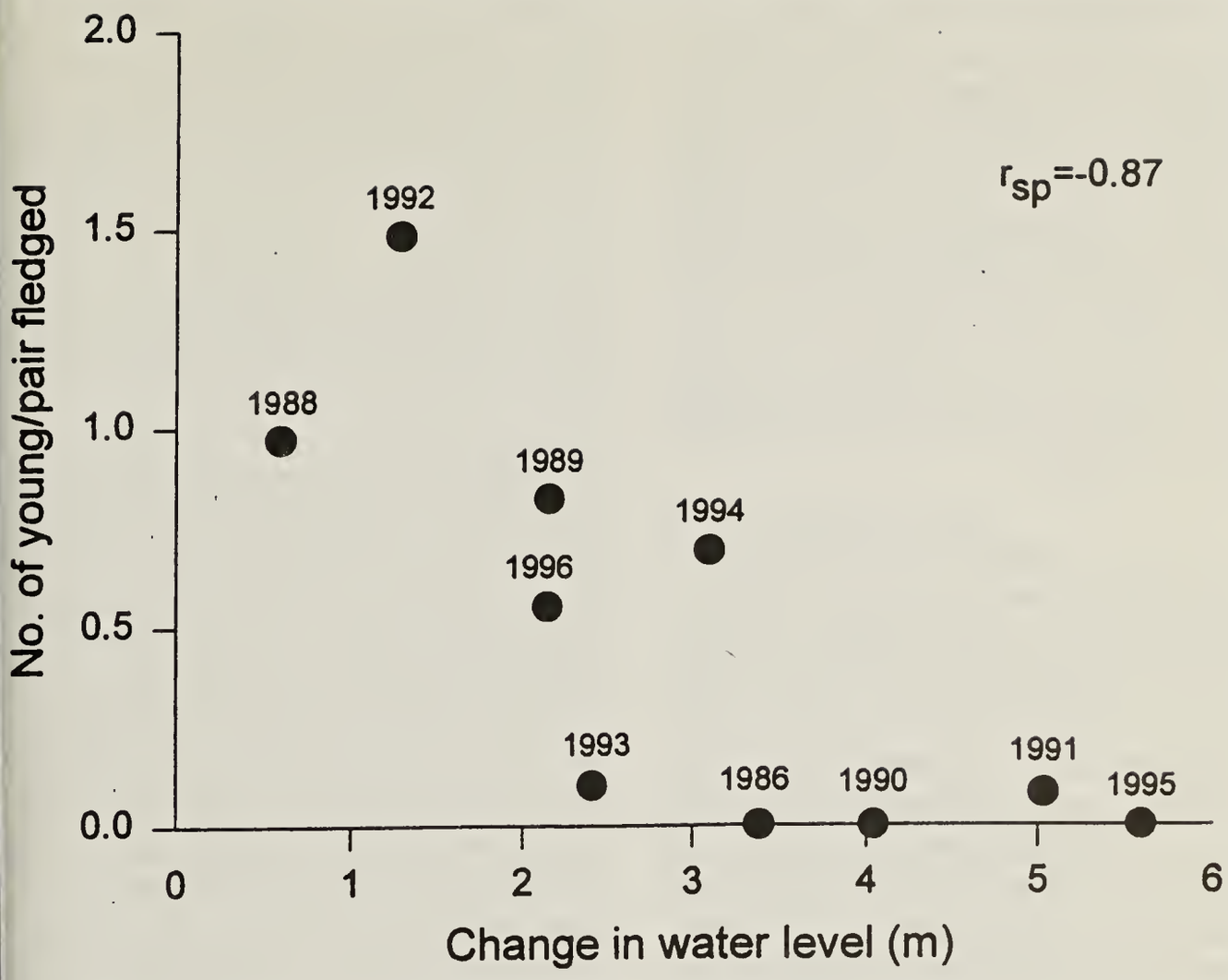


Figure 3. Fledging rate of Piping Plovers at Lake Diefenbaker versus change in water level from May 12 to July 1.

first half of July has been identified as the major threat to Piping Plover productivity at Lake Diefenbaker, it may be desirable to keep the population of plovers at Lake Diefenbaker low in years when rapid increases in water levels are expected over the summer[2,7,8,9,11,13,14,20]. Alternatively, it may be desirable to keep plover populations low in all years, although perhaps with the exception of extended periods of drought when Lake Diefenbaker's importance to plovers may increase as habitat at smaller basins diminishes[16]. The data from 1984 to 1996 strongly suggests that population levels of Piping Plovers can be minimized by keeping water levels >550.8 m on May 12 (Figure 1).

Productivity Studies The hatching and nest success of Piping Plovers was determined from a sample of the population for 5 years from 1991 to 1996 (Table 1). A measure of fledging success is determined from samples for 10 years from 1986 to 1996 (Table 1).

Hatching success (the number of chicks hatching per pair) varied from 0.6-2.4 young/pair. In all years the nests examined were distributed around the lake, with the exception of 1993 when most nests were located near the Qu'Appelle Dam[2]. Hatching success may be slightly inflated for 1993 as 1992 data (subset, Table 1) indicates slightly higher hatching success near the Qu'Appelle Dam than overall at the lake.

Nest success (per cent of nests hatching >1 chicks) varied from 7-60% and was often low. Calculated nest success, or Green's estimator of calculated nest success, are used (rather than observed apparent nest success) as these more accurately reflect actual nest success

by determining a success rate from the time a nest is located until it hatched or failed[12,4]. The proportion of nests lost to flooding was high (40-60% of all nests) in 4 of the 5 years: 9 of 22 nests in 1991, 1 of 30 nests in 1992, 23 of 39 nests in 1993, 13 of 32 nests in 1995, and 8 of 20 nests in 1996[14,20,2,13,11].

Fledging success (the number of chicks fledging per pair) was calculated in 1 of 2 ways:

(1) In some years a brood census was conducted in early July. An estimated fledging success was determined for each of these years in the following manner: the number of young on the brood census was compared to the number of pairs that were counted over the same census area on the late May to early June pair census. Data and maps from reports were used to determine number of pairs and census areas. Territorial individuals are included as pairs; in 1991 Harris and Lamont found all territorial birds (n=13) to be associated with nests[9]. Fledging success calculated from a July brood census represents an index of fledging success, rather than actual fledging success. This index may vary from actual fledging success because it assumes all young counted on a brood census survive to fledging (averaging 1 week later), and that a one-time brood census is as accurate as regularly monitoring a brood.

(2) In the other years, fledging rate was determined by the more accurate method of monitoring a specific sample of nests through until fledging. This occurred from 1991-1996 excluding 1994. In some instances the index to fledging success may reflect a truer fledging success as it includes a larger and more broadly distributed sample. In 1991, no young fledged from the sample of 22 nests, whereas an estimated fledging success index of 0.1 young/pair was determined from an early July brood census of the Arms (91 pairs), which yielded 7 young[14,9]. In 1992, the fledging rate was determined from a sample of nests in which most were located at one study site[1]. The estimated fledging success index for this year determined from an early July brood census, may again be more representative of the lake as a whole[20].

Fledging success, like the population count of plovers at Lake Diefenbaker, is highly variable among years. When fledging success is compared to July 1 water level in the reservoir, a strong relationship is apparent (Figure 2). By July 1 most nests have hatched (mean hatch date is June 14; Table 2), and sufficient chick-rearing habitat is critical to fledging success (mean fledge date is July 9; Table 2). When July 1 water level is above 556.0 m, fledging success is consistently near zero. In 2 of the 3 years when the July 1 water level was 555.0-556.0 m, fledging success was noticeably higher than the other year (1991) when fledging success was near zero. In the 2 years of higher fledging success (1994 and 1996), birds may have been nesting higher up on beaches than in 1991 because the May 12 water level in 1991 was very low compared to 1994 and 1996. This may have provided considerably more opportunity for birds to nest lower on the beaches in 1991, and thus resulted in a higher risk of loss to flooding as water level rose.

When fledging success is compared to the increase in water level between May 12 and July 1 another strong relationship emerges (Figure 3). Higher fledging rates occurred at lower changes in water level. When water level increases were >3.1 m, complete or nearly complete reproductive failure occurred. It is apparent that both May 12 water level and increase in water level between May 12 and July 1 are importan

to fledging success. The 2 years with the highest fledging success (1988 and 1992) had the lowest May 12 water level (#550.8 m) and the lowest change in water level between May 12 and July 1 (#1.3 m).

The strong relationship between fledging success and both July 1 water level and increase in water level between May 12 and July 1 provides another opportunity for water management. In the 5 years when the July 1 water level was <556.0 m and the water level rise between May 12 and July 1 was <3.1 m (1988, 1989, 1992, 1994, and 1996), complete or nearly complete reproductive failure was avoided and fledging success averaged 0.90 young/pair (n = 5 years; range = 0.6-1.5 young/pair). In the 5 years when water regimes did not follow this pattern, fledging success was near zero. The data suggests that water regimes conforming to the former parameters would greatly improve productivity of plovers at Lake Diefenbaker.

The suggested reproductive success for an annual population increase of 1% for this endangered species is 1.16 young per pair[15]. Although the fledging success was above the 1.16 young/pair rate in only 1 year (1992), the average fledging success of 0.90 young/pair for the 5 years approaches this value. A water management regime that averages $1.16 young per pair over all years would enhance recovery of this species overall.

Fledging success might also be increased if other management action were taken near the Qu'Appelle Dam where high concentrations of nesting plovers consistently occur. In 1991-1996, from 10-35% of the reservoir's population were counted along the shore west of the Dam in the vicinity of Summit Creek. In 1992, when overall fledging success was estimated at 1.5 young/pair, the success at a study site north of Summit Creek was very high at 2.5 young/pair (48 chicks from 19 nests)[20,1]. With its high concentration of plovers and high fledging rate in years when nests are not flooded, maintenance and possibly enhancement of this beach area, and/or management of the plovers which nest there, may be considered.

Acknowledgements

We are grateful to the many people involved in the studies of Piping Plovers at Lake Diefenbaker over the past years. The completeness of this summary is due to their dedication and effort in collecting data. We thank Don McKinnon for calculating the Green's estimator for nest success, Steve Davis for help with the graphs, and Dave Richards for providing Lake Diefenbaker water levels.

1.ESPIE, R.H.M., R.M. BRIGHAM and P.C. JAMES. 1992. Breeding ecology of the Piping Plover at Lake Diefenbaker, Saskatchewan. Canadian Wildlife Service, Edmonton. Unpub. 31 pp.

2.ESPIE, R.H.M., P.C. JAMES AND R.M. BRIGHAM. 1994. The effect of water level fluctuations on Piping Plover (*Charadrius melodus*) breeding success at Lake Diefenbaker, Saskatchewan. Canadian Wildlife Service, Edmonton. Unpub. 31 pp plus appendix.

3.——. *In press*. The effects of flooding on Piping Plover *Charadrius melodus* reproductive success at Lake Diefenbaker, Saskatchewan, Canada. Biological Conservation.

4.GREEN, R.E. 1989. Transformation of crude proportions of nests that are successful for comparison with Mayfield estimates of nest success. *Ibis* 131: 305-306.

5.HAIG, S.M. 1991. Piping Plover. Pages 1-16 *in* A. Poole, P. Stettenheim and F. Gill,(eds.), Birds of North America. American Ornithologists Union, Phila*delphia, Pa.*

6.HARRIS, W.C. 1988. Piping Plover survey - 1988: South Saskatchewan River - Lake Diefenbaker segment (Riverhurst Ferry to the Dams). Sask. Natural History Society, Regina. Unpub. 10 pp. plus map.

7.HARRIS, W.C., S.M. LAMONT and A. SEQUIN. 1989. Saskatchewan Piping Plover surveys - 1989: Big Quill Lake, Lake Diefenbaker, and Redberry Lake. Sask. Natural History Society, Regina. Unpub. 18 pp.

8.HARRIS, W.C. and S.M. LAMONT. 1990. Saskatchewan Piping Plover population assessment - 1990: Big Quill Lake, Chaplin Lake, Lake Diefenbaker, Redberry Lake and the South Saskatchewan River (Gardiner Dam to Saskatoon). Sask. Environmental Society, Saskatoon. Unpub. 15 pp. plus appendix.

9.HARRIS, W.C. and S.M. LAMONT. 1991. Saskatchewan Piping Plover population assessment - 1991: Big Quill Lake, Chaplin Lake, Lake Diefenbaker, Redberry Lake and the South Saskatchewan River (Gardiner Dam to Saskatoon). Sask. Environmental Society, Saskatoon. Unpub. 32 pp. plus maps.

10.HARRIS, W.C., G. WAPPLE, R. WAPPLE, K. DESMET and S.M. LAMONT. 1985. Saskatchewan Piping Plovers - 1984. Sask. Natural History Society and Sask. Parks & Renewable Resources, Regina. Unpub. 106 pp. plus appendix.

11.HJERTAAS, P. 1996. 1996 Piping Plover follow-up at Lake Diefenbaker. Sask. Wetland Conservation Corp., Regina. Unpub. 8 pp.

12.MAYFIELD, H.F. 1975. Suggestions for calculating nest success. *Wilson Bulletin* 87: 456-466.

13.MCADAM, S.M. 1995. Lake Diefenbaker Piping Plover survey 1995. Sask. Wetland Conservation Corp., Regina. Unpub. 21 pp.

14.ROBINSON, L. and D. HJERTAAS. 1991. The effect of water level management on the Piping Plover at Lake Diefenbaker. Sask. Parks & Renewable Resources. Unpub. 35 pp.

15.RYAN, M.R., B.G. ROOT and P.M. MAYER. 1993. Status of Piping Plovers in the Great Plains of North America: A demographic simulation model. *Conservation Biology* 7: 581-585.

16.SKEEL, M.A. 1994. The 1991 Piping Plover census in Saskatchewan. Pages 35-42 *in* Fleming, S.F. (ed.), The 1991 International Piping Plover Census in Canada. Canadian Wildlife Service Occasional Paper No. 82, Ottawa.

17.SKEEL, M.A. 1997. Population size and productivity of Piping Plovers at Lake Diefenbaker in relation to water levels - 1984 to 1996. Sask. Wetland Conservation Corporation, Regina. Unpub. 20 pp. plus appendices.

18.SKEEL, M.A., D.C. DUNCAN and E.R. WILTSE. 1996. Saskatchewan results of the 1996 international Piping Plover census. *Blue Jay* 55(3): 157-168.

19.SKEEL, M.A. and D. HJERTAAS. 1993. Saskatchewan results of the 1991 international Piping Plover census. *Blue Jay* 51(1): 36-46.

20.WAIT, B. 1992. Piping Plover Survey of Lake Diefenbaker - 1992. Environment & Resource Management, Regina. Unpub. 7 pp.

Table 1. Population size and productivity of piping plovers at Lake Diefenbaker, Saskatchewan, from ferry to the Gardiner and Qu'Appelle Dams. Productivity is determined from a sample of the population

Year	No.[a] of birds	No. of pairs	No. of nests in sample[a]	No. of young hatched	Hatching success (yg/pr)	Nest success (%)[b]	No.[c] of young fledged	Fledging success (yg/pr)[c]	Pair success (%)[c]
1984[10]	360 E [217]	[98]	--	--	--	--	--	--	--
1986[d]	low	low	--	--	--	--	0	0	0
1988	97[6]	46[6]	35[6]	--	--	--	34[7] E	1.0 E	--
1989[7]	135 E [94]	[35]	35	--	--	--	27 E	0.8 E	37.1 E
1990[8]	61 E [33]	[11]	7	--	--	--	0	0	0
1991	264[19]	116[19]	22[14]	13[14]	0.6[14]	20.5[14] G	0[14]	0[14]	0[14]
1991 Arms only			91[9]	--	--	--	7[9] E	0.1[9] E	6.6[9] E
1992[20]	140	78	40 62 E	96 --	2.4 --	47.7 G --	-- 92 E	-- 1.5 E	-- 61.3 E
subset of above[1]			30	83	2.8	60.1 G	55	2.0	71.4
1993[2]	167 E [78]	[39]	39	33	0.8	8.6 G	4	0.1	5.1
1994[e]	96 E [83]	[39]	39 E	--	--	--	27 E	0.7 E	38.5 E
1995[13]	120 E [102]	[45]	29	21	0.7	6.8 C	0	0	0
1996	71[18]	28[18]	20[11]	35[11]	1.8[11]	33.0[11] C	11[11]	0.6[11]	25.0[11]

[a]E denotes an estimate (see text for explanation); actual number counted is in [ ].

[b]Nest success is the percent of nests hatching ≥ yg. Calculated (C) percent determines success from time a nest is located[12]. Green's estimator (G) converts observed success to an estimate of Mayfield's calculated success[4].

[c]E denotes an estimate: assumes all yg counted on a July brood census fledge. Pair sucess is the observed percent of prs fledging ≥1 yg.

[d]W.C. Harris, Unpubl. data. Counted 0 birds on a 28 June census; little beach area due to high water.

[e]D. Hjestaas, Unpubl. data. A 30 May-1 June census of most of the habitat (3 sections not censused). A 6-7 July brood census (34 adults). *Fledging success*: assumes the 27 yg were from 39 nests. *Pair success*: assumes the 15 prs with ≥ yg on the brood census all fledged ≥1 yg.

[1]Data from 3 study siotes, each approx. 1.5 km: near Qu'Appelle and Gardiner Dams, and w of Sage Bay. *Nest success*: 23 of 30 nests hatched ≥1 yg; 1 nest was lost to flooding, 6 to unknown predators or human disturbance. *Fledging success*: 28 nests with known fate fledged 55 yg. Assumes yg not fledged by 23 July survuve. *Pair success*: 20 of 28 nests fledged ≥1 yg.

[2]Data from the 1992 study sites[1] and 2 additional sites, each approx. 1.5 km: e of Sage Bay and 10 km nw of town of Elbow. *Nest success*: 9 of 39 nests hatched ≥ yg; 23 nests were lost to flooding, 7 to unknown predators. *Pair success*: 2 of 39 prs fledged ≥ yg.

[3]A 27-31 May census. The 30 prs and 5 territorial singles counted in the Thomsom and McKenzie Arms are assumed to be 35 prs with nests.

[7]In 1988, 34yg on an early July brood census of the ASrms. Fledging success assumes the 34 yg were from 35 nests. In 1989, a 6-8 June census of most of the Arms; Riverhurst Ferry to the Arms not censused. *Fledging success*: 8 and 11 July brood census (56 adults, 13 family groups). Assumes the 27 yg were from 35 nests.

[8]A 14 June census of the Arms; Riverhurst Ferry to the Arms not censused. No birds on a 4 July brood census.

[9]Counted 91 nests (223 adults) in the Arms on a 1, 2 and 8 June census. *Fledging success*: 6-7 July brood census of the Arms (20 adults, 6 family groups). Assumes the 7yg were from 91 nests.

[10]A 9-10 July census of shoreline totalling 243 km; several sections of habitat not sensused.

[11]One nest not found but pr was subsequently located with 2 yg (4 eggs, all hatching, are assumed). *Pair success*: 5 of 20 prs fledged ≥1 yg.

[13]Counted 96 adults (45 prs) on an early June sensus of selected beaches; 6 more without nest counted by T. Tyndall in 2 additional areas. *Pair success*: 1 yg survived >1 wk, likely did not fledge due to high water and greatly reduced habitat.

[14]Monitored 22 nests at 3 sites: 8 near Qu'Appelle Dam, 7 near Gardiner Dam, and 7 near Sage Bay. *Nest success*: may be an overestimate as (unlocated) neast may have flooded before moniitoring began on 9 June. Of 22 nests, 13 hatched ≥ yg; 9 were lost to flooding.

[20]A 2-15 June census. *Number of pairs*: 54 pairs and 24 territorial singles. Nest success: 27 of 40 nests hatched ≥1 yg. *Fledging success*: 8-13 July brood census (104 adults; 50 prs); estimate that 62 nested in the area censused. Assumes the 92 yg were from 62 prs and that all yg not fledged by 23 July survive.

Table 2. Nest Chronology for Piping Plovers at Lake Diefenbaker, Saskatchewan

Year	Number of nests	Mean nest initiation date (range)[a]	Mean hatch date (range)	Mean fledge date (range)[b]
1991[14]	13	May 14 (May 11-28)	June 17 (Jun 14-Jul 1)	July 14 (July 11-28)
1992[1]	22	May 11 (May 5-June 1)	June 14 (Jun 8-Jul 5)	July 11 (July 5-32)
1993[2]	9	May 7 (May 3-13)	June 10 (June 6-16)	July 7 (July 3-13)
1995[13]	6	May 8 (May 6-13)	June 11 (June 9-16)	July 8 (July 6-13)
1996[11]	5	May 19 (May 14-28)	June 22 (Jun 17-Jul 1)	July 19 (July 14-28)
Average		**May 11**	**June 14**	**July 11**

[a]Initiation date is calculated using six days average laying time plus 28 days for incubation period.[5]

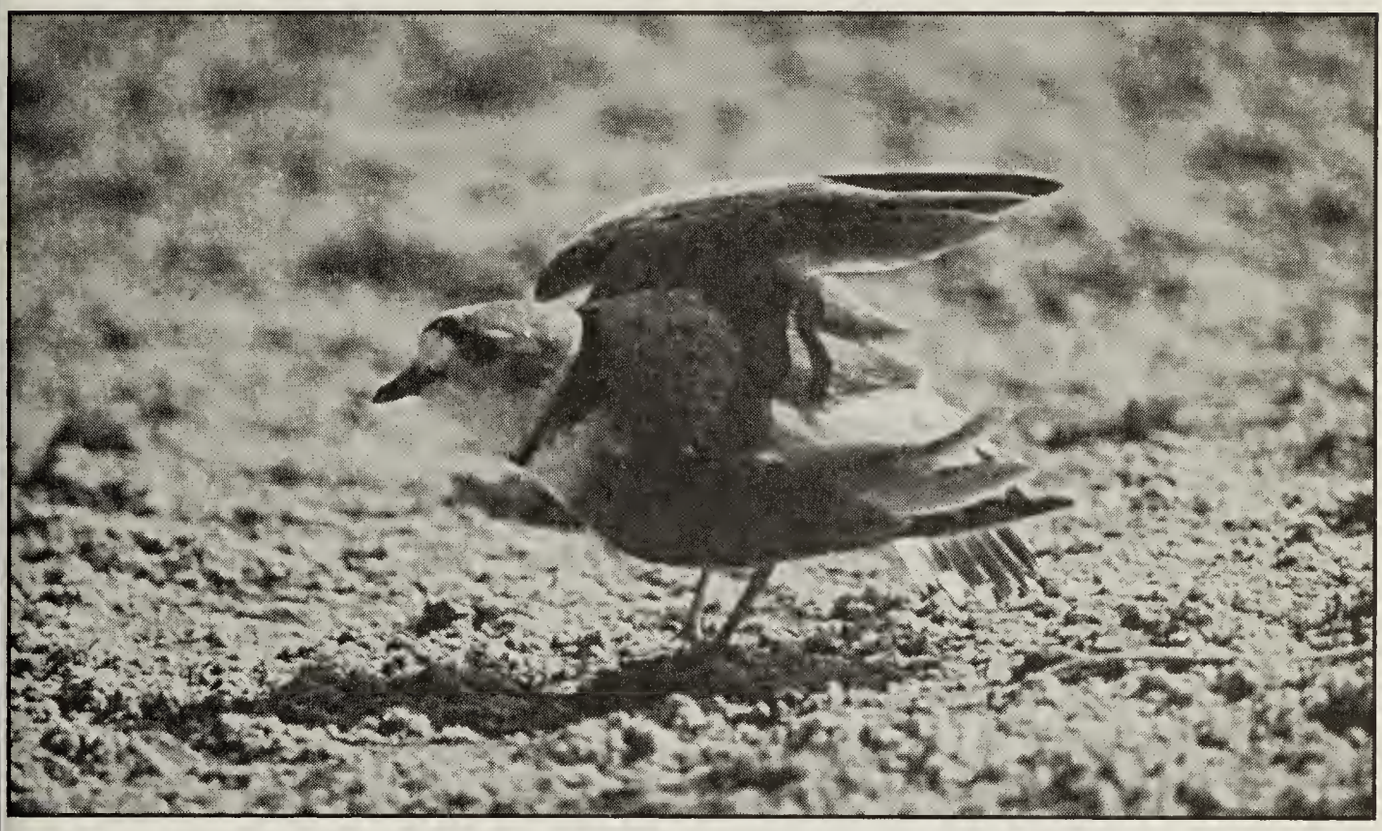
[8]Fledge date is calculated as 27 days after hatch date.[5]

[1]Excludes 1 probable renest (hatched 12 July).

[11]Excludes 2 probable renests (hatched 16 and 28 July).

MY EXPERIENCE IN MOVING 2 NESTS OF PIPING PLOVERS

PAULE HJERTAAS,15 Olson Place, Regina, SK S4S 2J6



Piping Plover *Saskatchewan Wetland Conservation Corporation*

During the summer of 1996, I was hired by Saskatchewan Wetlands Conservation Corporation (SWCC) to study the nesting success of Piping Plovers on Diefenbaker Lake. Their total population was only 78 birds in 1996, likely because of very high water levels during the period when the birds established territories. I managed to follow 18 pairs and two renests throughout the summer.

Diefenbaker Lake is a reservoir that has a main filling period corresponding with the snow melt in the Rockies, which is usually end of June and early July. This is just as the plover eggs are close to hatching after their 28 days incubation.

My visits were four days apart and many nests and young disappeared in these intervals. Two nests, that had eggs with only a short time to pipping, were being threatened by rising water levels. After phoning Dale Hjertaas (who had just read a recent successful report from the U.S.A), we decided it would be a good idea to try to move them[1].

My observations and experience in moving these two nests are given below:

Hitchock Bay

The first nest, called Hitchcock 8, was located on Hitchcock Bay. On June 19, it was surrounded by water within 30 to 60 cm on three sides. In cloudy, cool and windy weather, I returned to the area on June 20 before 6 a.m. and moved the nest 6 m. up the beach with some of the gravel at the bottom and the

marker rocks surrounding it. After 20 minutes, I could still see the parents searching the whole beach, seemingly in a random pattern, and sitting on the original nest site, even with the marker rocks gone. Around 6:11, the eggs were cold and I concluded the move was too far all at once. I moved the nest back within 45 cm of the original site, dug a small depression in the sand, leaving a small sand pile at the edge, and put a bit of gravel. By 7:20 one parent was sitting on the nest and the eggs were warm. Then, I moved the nest another 60 cm.

By 7:49, the female was again sitting on the eggs and they were warm again. I moved them up another 60 cm. By the time I had walked back 30 m, the bird came back to the previous site, looked around, spotted the eggs at their new site, went over and sat on them immediately.

The beach was so long and flat that I moved the nest a longer distance, one m, at 8:08. One bird was giving a broken-wing display close to me the whole time. Again that bird went to the previous nest location first, then came directly to where I had moved the nest and sat on it. I am sure it clearly saw what I was doing.

At 8:33, I moved the nest another 1.2 m. The adult went straight to the new location without checking the previous site. It was staying within 1.5 m of me every time I moved the eggs. At 9:00 a.m. I tried a two m jump to the first site I had moved the nest to but this was too far. The bird checked all the previous sites in a panic before I was more than 15 m away. I moved it back to 1.2 m from previous site, but the bird did not locate the nest. I had to settle for a 0.6 m move only, where the bird could see the eggs when standing at the previous site. It settled on the nest in the new location right away. By that time, I got worried about how many times I could safely move that nest! At 9:45, I did a double move of 0.6 m each. I let the bird find the new location and sit before I moved it again. In spite of the distance I moved the nest, it was still only about 3 cm above water level. I conclude it was the other adult (the male?) in attendance at the nest as it ran away from me.

At 10:00, I managed a successful triple move with the bird again just sitting in the new location before the nest was moved again, for a total distance of 2.3 m. The bird attending was likely the female as it stayed close to me and very quickly came back directly to the new location. I discovered that one egg has a small dent in it on one side, like it had a little peck. This time, I moved the rocks found around the original nest site as well as the pile of soil from all my diggings to the new location.

At 10:51, I succeeded in three successive large moves of 1.5 m each time with the bird going right back to the new location. She seemed well trained now, likely zooming in on the marker rocks and the dirt pile, going back to the new site when I was less than two m from the new location. The nest was still only about 5-7 cm above water level though!

Shortly after 11:00, I tried a final two successive moves of around 1.3 m. The bird did not find the last location, so I back tracked one location, waited a few minutes for it to get used to it and tried again. I had to subdivide this last move into two smaller ones so she could find the eggs each time from the previous location. The bird took over 10 minutes to settle in the last location. It did not seem to like going over the small ridge. The nest was finally located around 10 cm above water level and had around six days to hatching.

On June 27, Margaret Skeel returned to Hitchcock Bay to find water surrounding the nest within 30 cm again on three sides. The parents were both still present. The eggs were warm but showed no sign of hatching. She used the technique described previously to move the nest another six m up the beach. The parents did not follow on the last move she made, so she had to move back to a lower than she felt was safe.

When she returned, the whole area was under water except a small "island" which she checked thoroughly. No adults or young Piping Plovers were found at that time.

The location of the second nest, which gave me an opportunity to attempt a move, was called Sage 1. On June 20, I found it surrounded by water within 30 cm on three sides. The substrate was very moist. I managed a successful double move, then went to look for Sage 2.

When I came back, I moved Sage 1 twice 0.6 m again. With this move, the bird went back to the original nest site and tried every alternative site in the proper order and in turn until it found the new location. I waited 10 minutes.

A further two moves of 0.6 m each and the nest should be 4 cm above water level. Again, the final spot I chose was on the other side of a ridge, but the birds would not recognize this as a proper location. They ran back and forth over the nest without seemingly recognizing it. I had to move the nest back to two previous locations and let the birds go through a sitting exchange at this site. Within 5-10 minutes, there was another sitting change at the nest and the arriving bird again went to look at all the previous locations. It finally realised where the nest was and sat on it.

The final location was finally 0.6 m below the ridge I had identified as safe. This was because the birds would not recognize the nest in the higher location. I noticed one egg having a very light crack near the small end.

Discussion

This experiment shows that nests can successfully be moved up the beach to escape water level rises. Despite the move, the parents recognized the new nest site and returned to it to brood. We do not have evidence indicating whether or not the moved eggs hatched. The Hitchcock 8 nesting site was under water at the next visit on July 1st. I estimated it was one day beyond the normal hatching date, but this can vary by 2-3 days. Sage 1 had hatched at least one chick by June 27, which had disappeared by July 1st. On both latest visits, the beach at Sage 1 had been only 10-15 m. wide which has been identified by Wayne Harris as short of the critical width needed for Piping Plovers to successfully raising young.(pers. comm.)

Whether the parents stay and move with the nest seems to be due to various factors. This includes how often they exchange duty at the nest. A change of duty had to be done at a new location before both birds are aware of it. The female was mostly in attendance at Hitchcock Bay and the moves were quite smooth and could be very fast. In contrast, the Sage Bay pair was replacing each other often at the nest that meant much backtracking. A longer time would likely be needed to have success with such a pair as both partners have to be aware of the new locations. Also moving the nest within a seeing distance (for the birds) from the previous location seems fundamental to the success of the move. This was especially true in the early moves when the

birds are not accustomed to being moved. The topography of the beach is important. In both cases a "safe" location seemed difficult to accept if the birds had to go up a ridge to get there. Finally, the time allowed between the moves had to be adequate. The longer the time, the more chances both parents are aware of the new location. It may also be less stressful for them.

Conclusion

Piping Plover nests can successfully be moved up a beach to escape rising water levels although the success of the operation depends on observation of the pair's behaviour, the topography of the beach, and the time to hatching.

I consider it would also be a waste of time if the remaining time to hatching is too long, likely requiring many more moves over a much larger area as water levels keep rising. It can, however, be questioned whether there is any point in moving nests to higher grounds if the beach area remaining at the high water mark is not wide enough to successfully raise young or to prevent predation of the young.

Acknowledgment

I would like to thank SWIC, particularly Dave Duncan, for giving me the opportunity to work on such an interesting project, Dale Hjertaas for his suggestion and support of the nest moving, and Margaret Skeel for replacing me on a few field visits.

References

1. Prellwitz, Dwain M., Erickson, Kathleen M, and Osborne, Lark M.;1995; Translocation of piping plover nests to prevent nest flooding; Wildlife Society Bulletin, 23(1): 103-106

Snowshoe Hare *George Tosh*

SWAINSON'S HAWK PRODUCTIVITY AND FIVE-YOUNG NEST

C. STUART HOUSTON, 863 University Drive, SK S7N 0J8

This is an account of a long-term study, but is also a story about four elements of incredibly good fortune.

Imagine initiating a study of the Ferruginous Hawk, which led to an even larger study of the Swainson's Hawk. Imagine what an impetus Jean Harris has given my hawk-banding program, finding 729 Swainson's Hawk nests, thereby propelling me into top spot among Swainson's Hawk banders. Imagine following this hawk through 12 consecutive years of excellent productivity, three years of good productivity, ten years of poor productivity, and then having the satisfaction of productivity in 1997 suddenly jumping back to equal the "good old days." And, especially imagine the excitement, in 1997, when Jean found the world's first recorded nest with five healthy nestlings almost ready to fledge. It was one of the most exhilarating experiences in 55 years of banding.

I like to say that when things go well, it reflects good management and when things go badly, that is bad luck. But when it comes to Swainson's Hawk and Jean Harris, I am the first to admit to being just plain lucky.

I did not plan a long-term study, I stumbled into it. In 1969, concerned about the drastically retracting range of Ferruginous Hawk in Saskatchewan, I encouraged my sub-permittee, Doug Whitfield, to check out a few former Ferruginous Hawk locations, west of Kindersley, that Glen A. Fox had reported in 1960. Doug went to four nests and had unexpected success: two nests had five young and two others had four young each. Although Ray Salt at Rosebud, AB, had mapped the migration routes and wintering grounds of Alberta Ferruginous Hawks in the 1930s,[8] nothing was known of the movement of Saskatchewan birds. Ferruginous Hawk banding has been an annual event ever since Doug's first success[3].

The next bit of luck concerned the time and place of the weekend camp of the Kindersley Boy Scouts, the only year we crossed paths at banding time. On 17 June 1972, when checking Ferruginous nests on the Kindersley-Elna PFRA Pasture, we saw that the solitary tree in the ravine near Teo Lake had an active pair of hawks. The Boy Scouts tents were 300 m away. Here was an opportunity to enrich the scouts' experience, so I went over and asked whether the scouts wished to observe the banding operation. To my surprise the enthusiastic scout master turned out to be Keith Harris, who had grown up on a farm three miles south of my hometown of Yorkton. His first cousin had found a Great Horned Owl nest for me there in 1953. Better yet, Keith informed me that his wife, Jean, was interested in hawks and had a couple of Swainson's Hawk nests that I might wish to visit the following month. Thus, a chance encounter led to annual assistance from Jean in finding nests of both Buteo species; her Swainson's peaked at 62 nests in 1987 (Table 1).

Swainson's Hawk productivity

Apart from one unexplained drop in nests found in 1976, Jean covered a

Year	Total nests	# nests success	# young banded	# nests failed	Ratio yg./successful nest		% Nests Successf
1972	3	2	4	1	2.00		66.67%
1973	7	5	11	2	2.20		71.43%
1974	9	6	14	3	2.33		66.67%
1975	11	6	13	5	2.17		54.55%
1976	2	1	3	1	3.00		50.00%
1977	15	10	25	5	2.50		66.67%
1978	17	14	41	3	2.93		82.35%
1979	19	15	38	4	2.53		78.95%
1980	15	9	19	6	2.11		60.00%
1981	20	17	33	3	1.94		85.00%
1982	26	24	50	2	2.08		92.31%
1983	47	32	59	15	1.84		68.09%
SUBTOT	191	141	310	50	2.20	Excellent production	73.82%
1984	35	20	36	15	1.80		57.14%
1985	38	32	67	6	2.09		84.21%
1986	41	38	81	3	2.13		92.68%
SUBTOT	114	90	184	24	2.04	Good production	78.95%
1987	62	49	80	13	1.63	lowest ratio ever	79.03%
1988	39	20	27	19	1.35	even lower	51.28%
1989	48	28	42	20	1.50	still low	58.33%
1990	47	34	50	13	1.47	still low	72.34%
1991	41	24	28	17	**1.17**	very low	58.54%
1992	47	29	40	18	1.38	still low	61.70%
1993	23	9	11	14	**1.22**	very low	39.13%
1994	26	25	47	1	1.88	best in 7 years	96.15%
1995	35	30	42	5	1.40	low again	85.71%
1996	28	16	27	12	1.69	better than Mantario	57.14%
SUBTOT	396	264	394	132	1.49	poor production	66.67%
1997	28	26	62	2	2.38	like old times	92.86%
TOTAL	729	521	950	208	1.82	young/ successful nest	71.47%

Table 1. Swainson's Hawk nests found by Jean Harris, Kindersley area, SK

wider area each year and found more and more nests. Like us, Jean is careful not to go near a Swainson's Hawk nest early in incubation. Only in mid-June are nesting pairs watched and then only from a distance, for fear of nest desertion. As a result we have no statistics on early nest desertion. During the first 14 years, from 60 to 90% of Jean's known pairs were successful in a given year, and productivity was more than two young per successful nest. From 1984 to 1986 this figure fell to almost exactly two per nest.

The next ten years, 1987 to 1996 showed more nest failures and declining productivity to only 1.17 young per successful nest in 1991 and 1.22 in 1993. Mid-breeding nest failures rose to an all-time high of 61% in 1993.

Another check on productivity is to graph the number of nests, province wide, with one, two, three and four young (Figure 1). From 1944 to 1994, only 19% of 3039 banded young were produced in nests with only one young[4]. The percentage of nests raising only one young to banding age, the solid black line on the graph, was 20% in the first 12 years, then rose to 50 % or more

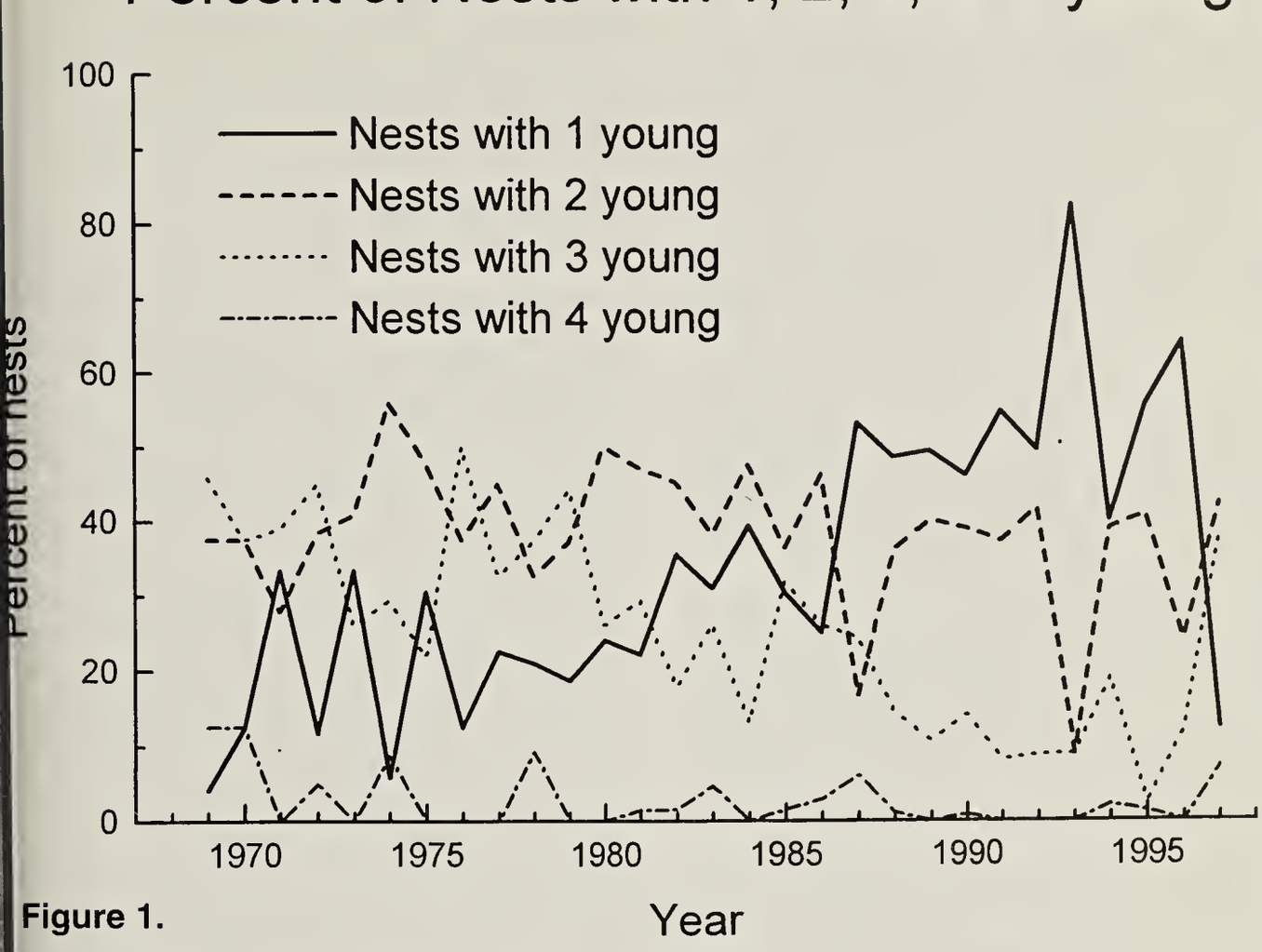


Figure 1.

from 1987 to 1996; peaking at 82% in 1993. Yet in 1997 this figure dropped back suddenly to 10%.

Swainson's Hawk Populations

Between 1987 and 1996, the number of nesting pairs dropped by approximately 50%. A similar approximately 50% drop occurred at Hanna, Alberta between 1989 and 1996. An even more drastic drop occurred in southwestern Saskatchewan (Josef K. Schmutz, mss., and Wayne C. Harris, pers. comm.).

Speculation

Grassland fragmentation no doubt has contributed to productivity declines in the Ferruginous Hawk and Burrowing Owl, but the Swainson's Hawk is much less a grassland specialist. Changing farm practices and chemical usage may be contributing causes. Ian Newton's wonderful "Population Ecology of Raptors" perhaps offers the best explanation: "almost every aspect of the natural population ecology of a given raptor species can be explained in terms of food."[6] The ten -year drop in numbers of Swainson's young per successful nest was accompanied by a drastic decline in numbers of Richardson's Ground Squirrel (RGS), a widespread phenomenon throughout the grasslands of southern Alberta and Saskatchewan. Our best guess is that numbers of RGS at Kindersley dropped below 5%, perhaps 2% of their former numbers; which were everywhere considered "superabundant" in the 1970s[7]. A similar RGS crash was not evident in parkland areas of Saskatchewan. One possible, partial, explanation of the ground squirrel decline was the appearance of the Red Fox, both at Luseland to the north

and Kyle to the southeast, in the mid 1960s, with subsequent dramatic increases[2,5].

RGS roadkills were common from 1950 to 1987. In over 10,000 km of travel each year, between 1992 and 1995, inclusive we saw only one such roadkill, whereas up to 3 Red Fox roadkills were encountered in one day. From 1992 through to 1996, days without a single RGS sighting were commoner than days without a Red Fox sighting. RGS numbers appeared to bottom out in 1993. By 1996 and 1997 there were increasing numbers of small pockets of RGS, sparingly distributed. The largest groups in 1996 being 20 near Hillsburgh Pasture Headquarters south of Brock and another nine near Laporte, on 21 June. These increases seemed insufficient to explain the sudden improvement in productivity in 1997. However, voles, which proliferated everywhere in southern Saskatchewan in 1997, offer at least a partial explanation. Vole numbers rivalled the years 1960 and 1969; all three springs followed some of the wheat and other crops lying unharvested all winter under the early snow. Although not reflected in prey remains in nests by banding time, this abundant food supply may have helped both species of Buteo get off to a good start in 1997.

Five-young nest

A thorough literature search revealed a single report of a five-egg clutch in 1915, classed as questionable, and no reports of five young[1]. Hence it was a surprise on 23 July when we followed Jean Harris's directions to a nest alongside Highway 21, south Kerrobert, to find five healthy young Swainson's Hawks. The nest was 4.3 m above ground in a Manitoba Maple, along the north edge of a farm shelterbelt, and, in spite of the large brood we found two Richardson's Ground Squirrel skins in the nest. One adult was erythristic (reddish plumage) and one light. All five young were similarly erythristic and nearly ready to fledge: indeed one flew five m and was replaced in the nest. This appears to

Five Swainson's Hawks in one nest. *Jean Harris*

be the world's first recorded Swainson's Hawk nest with five young.

1. ENGLAND, A.S., M.J. BECHARD, and C.S. HOUSTON. 1997. Swainson's Hawk (*Buteo swainsoni*). In The Birds of North America, No. 265 (A. Poole and F. Gillis, eds.). The Academy of Natural Sciences, Philadelphia, PA and the American Ornithologists Union, Washington, D.C.

2. FINLEY, K. 1996. The Red Fox invasion and other changes in wildlife populations in west-central Saskatchewan since the 1960s. *Blue Jay* 54:206-210.

3. HOUSTON, C.S. 1995. Thirty-two consecutive years of reproductive success at a Ferruginous Hawk nest. *J. Raptor Res.* 29:282-283.

4. HOUSTON, C.S. and J.K. SCHMUTZ. 1995. Declining reproduction among Swainson's Hawks in prairie Canada. *J. Raptor Res.* 29:198-201.

5 JORDHEIM, S.J. 1995. Foxes in south-central Saskatchewan. *Blue Jay* 53:232-233.

6. NEWTON, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, S.D.

7. ROTHFELS, M. and M.R. LEIN 1983. Territoriality in sympatric populations of Red-tailed and Swainson's Hawks. *Can. Zool. J.* 61:60-64.

8. SALT, R. 1939. Notes on recoveries of banded Ferruginous Rough-legged Hawks (*Buteo regalis*). *Bird-Banding* 10:80-84.

Mariposa Lily - Waterton Lakes National Park *Teresa Dolman*

INTERPROVINCIAL RECOVERIES OF MOUNTAIN BLUEBIRDS AND TREE SWALLOWS, AND A CALIFORNIA RECOVERY OF A TREE SWALLOW

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Often, migrating Mountain Bluebirds and Tree Swallows return to near their nesting sites in subsequent seasons. Calgary area banders have found that a bird banded as an adult may even return to the same nest box it used the previous year, or usually at least within five km. They have found that birds banded as nestlings disperse and are more likely found further away in subsequent years than those banded as adults, but often within twenty four kilometres of their natal site. Occasionally, a bird will get off track and return to a different province. A few birds which have done this are described below.

Mountain Bluebirds:

8051-54109, a Mountain Bluebird was banded as a nestling in 1993 by Jim Speer, near Shellmouth, MB, just east of the Sask. border west of Riding Mountain National Park, and recovered as an incubating female in a nest box east of Priddis, AB by Andrew Holder, a subpermittee of Don Stiles, on June 13, 1996. This is the first band recovery from Manitoba to Alberta. The recovery location is 890 km. straight west of the banding location.

This prompted an examination of the recoveries of Mountain Bluebirds to determine whether there were any other "interprovincial" recoveries. Table 1 and Figure 1 show four other "interprovincial" recoveries recorded from 1970 to 1994 found in data supplied by Canadian Wildlife Service. One moved from SK to MB, one from SK to AB, and two moved from AB to SK.

Distances varied from 155 km (near Provost, AB to east of North Battleford, SK) to 680 km (near Viking, AB to east of Melville, SK). Three were recovered alive in nest boxes and two were found dead. All of these birds except the first one in Table 1 were banded as nestlings, then travelled south on migration and returned to another province one or more years later. The exception, 1091-36438 was banded as an adult female by Lorne Scott on May 24, 1973 near Grenfell, SK, and was captured in a nest box near Souris, MB on June 21, 1973, a surprising distance of 200 km from where banded.

A Mountain Bluebird, 991-05960, recovered in Vancouver, BC, (Lat-Long 49 10',123 00') on Aug. 10, 1987, is not listed in Table 1. A phone call to the band recoverer, revealed that he was a long distance trucker, and the banded bird had been found dead by his son on the flatbed of his truck while it was being cleaned. He had recently hauled a load of prefabricated log houses from Cochrane, AB to Vancouver. This bird was banded by Marijke Jalink, a subpermittee of Don Stiles, on July 13, 1987 near Millarville, AB (Lat-Long 50 40',114 20'). After it fledged, it is speculated that the bird flew about 50 km north

Tree Swallows *Wayne Lynch*

to Cochrane or vicinity where it was hit by the truck. It then travelled to Vancouver on the truck bed and was recovered on August 10.

Tree Swallows:

Only two Tree Swallow interprovincial recoveries were found in the Canadian Wildlife Service data up to 1992. One banded in Saskatchewan was recovered in Manitoba, and one vice versa. One of these, 520-49136, was banded as an adult in 1958 and recovered in 1960, making this bird at least three years old. The second, 880-41966, was banded as a nestling by Mary Houston on July 7, 1977 near Pike Lake, SK, and recovered near Altamont, MB after hitting a power line in August 1977. Presumably this bird had already begun its migration.

A California Tree Swallow Recovery:

121-85793, a Tree Swallow banded as a nestling by George Loades, a subpermittee of Don Stiles, on July 8, 1995 on his Jumping Pound bluebird trail southwest of Cochrane, AB, was recovered alive in a mist net at the Modoc National Wildlife Refuge in northeastern California on April 12, 1997. (See Table 1 and Figure 1) This is the

Table 1 - Interprovincial Recoveries of Mountain Bluebirds and Tree Swallows banded in the Prairie Provinces, and a California Tree Swallow Recovery

			Banding			Recoveries						
			Where Banded			Where recovered						
Bander	Band No.	Age*	Lat.-Long.	Loc.	Date	Lat.-Long.	Loc.	Date**	Age	How***	Distance (km)	Degrees
	INTERPROVINCIAL MOUNTAIN BLUEBIRDS											
R.L. Scott	1091-36438	F	50 10',103 00'	SK	73/05/24	49 40',100 20'	MB	73/06/21	1	33	200	105 SE
M.I. Houston	1101-44809	L	52 10',106 50'	SK	73/06/14	52 10',110 20'	AB	75/07/13	2	33	240	270 W
J.C. Finlay	891-17637	L	53 00',112 00'	AB	82/06/15	50 50',102 40'	SK	83/05/18	1	0	685	107 SE
R.S. Johnson	991-22912	L	52 10',110 20'	AB	88/06/02	52 40',108 10'	SK	92/06/06	4	0	155	68 NE
J. Speer	8051-54109	L	50 50',101 30'	MB	93/06/20	50 50',114 10'	AB	96/06/13	3	33	890	270 W
	INTERPROVINCIAL TREE SWALLOWS											
R.R. Taylor	520-49136	Ad-u	50 10', 98 10'	MB	58/07/27	50 30',101 50'	SK	60/05/30	3	33	265	280 NW
M.I. Houston	880-41966	L	51 50',106 40'	SK	77/07/08	49 20', 98 30'	MB	77/08/xx	0	54	640	113 SE
	A CALIFORNIA TREE SWALLOW RECOVERY											
D.J. Stiles	2121-85793	L	51 00',114 30'	AB	95/07/08	41 20',120 30'	CA	97/04/12	2	89	1175	208 SW

*Age: L - Local, unable to fly
F - Adult Female
Ad-u - Adult, sex unknown
- For adult birds, age at banding is assumed to be 1 year old.
**xx - Date unknown

***How Codes
0 - Found Dead (2 mb, 1 ts)
33 - Caught in nest (3 mb)
54 - Struck wire (1 ts)
89 - Trapped and Released (1 ts)

Figure 1. Interprovincial Recoveries of Mountain Bluebirds and Tree Swallows, and a California Tree Swallow Recovery. ▶ - Mountian Bluebirds. ■ - Tree Swallows

first Tree Swallow banded in Alberta that has travelled southwest on migration. All 16 previously banded in Alberta have been recovered to the southeast[1,2]. One factor in this may be that this bird was banded in the foothills southwest of Calgary, one of the more westerly locations in Alberta where banding is done.

Ronnie L. Ryno, Assistant Manager at the wildlife refuge reports that they capture Tree Swallows in April and early May in mist nets, most of which later nest nearby in nest boxes. Also of interest in his letter: "during March and April we often get cold spells when the temperatures will drop into the low teens (°F), this usually results in dozens or even hundreds of dead Tree Swallows around their roost sites, especially if the cold weather lasts a few days and/or is combined with snow." This is another indication that weather plays a big factor in bird migration. Another Tree Swallow recovered in Nebraska, at much the same latitude as the above, died due to severe weather[2].

1. Stiles, D.J. and M.I. Houston. 1994. Distant Travels of Tree Swallows of the Prairie Provinces, 1968-1992. Blue Jay 52:206-212.

2. Stiles, D.J. 1997. Recoveries of Mountain Bluebirds south of 49º Latitude, and a recent Tree Swallow. Blue Jay 55:48-52.

HERPETILES AND FISH

AN UPDATED LIST OF THE FISHES OF SASKATCHEWAN

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The Saskatchewan Conservation Data Centre provides information for the conservation of Saskatchewan's biological diversity (see article on page 189 this issue). A basic role of the Centre is to maintain up-to-date species lists with Provincial and Global species' ranks (a species' estimated status) based on standardized methods developed by The Nature Conservancy over the past 24 years. An updated list of the fishes of Saskatchewan is presented (Table 1).

Recognizing that all ranking systems are meant to categorize species using artificial criteria and within non-biological political jurisdictions, and that information available for most species is often minimal at best, these lists are best thought of as preliminary or "working" documents. Their usefulness lies in providing a framework upon which discussions and suggestions for revisions can follow. They also identify gaps in our knowledge and help focus and priorize future research and conservation efforts. If you have suggestions for improving the list (i.e., additions, deletions, or changes), or information on the occurrence of rare Saskatchewan fish species (SRANK ≤ S3, see below), please contact the Saskatchewan Conservation Data Centre. Updated species lists are available from the Centre.

SPECIES RANKS

Brief definitions of global and provincial species ranks used by the Centre (denoted as GRANK and SRANK, respectively) are given below. Contact the Saskatchewan Conservation Data Centre for a more complete explanation of these ranks, including the use of ranking qualifiers for questionable species, subspecies and varieties, and the priority sequence of ranks.

<u>GRANKs</u>

G1 = critically imperiled globally
G2 = imperiled globally
G3 = either very rare and local throughout its range or found locally in a restricted range
G4 = apparently secure globally
G5 = demonstrably secure globally

GH = of historical occurrence throughout its range
GU = possibly in peril range-wide but status uncertain
GX = believed to be extinct throughout range
G? = not ranked to date
GQ = taxonomic status uncertain

SRANKs

S1 = Critically imperiled in the province
S2 = Imperiled in the province
S3 = Rare or uncommon in the province
S4 = Widespread, abundant, and apparently secure in the province,but with cause for long-term concern
S5 = Demonstrably widespread, abundant, and secure

S#S# = Numeric range rank
S? = Unranked
SE = Exotic
SA = Accidental
SP = Potential
SR = Reported
SRF = Reported falsely
SH = Historical
SU = Unrankable
SX = Extirpated

ACKNOWLEDGEMENTS

I would like to thank Joyce Belcher, Maynard Chen, Ron Jensen, Jeff Keith, Kurt Mazer, Bruce McCulloch, Al Murray, Keith Roney, Bill Sawchyn, Ken Stewart and staff of The Nature Conservancy and of the Royal Saskatchewan Museum for their critical review and input.

LITERATURE

ATTON, F.M. and J.J. MERKOWSKY. 1983. Atlas of Saskatchewan fish. Department of Parks and Renewable Resources. Technical Report 83-2. 281pp.

PAGE, L.M. and B.M. BURR. 1991. A field guide to the freshwater fishes. Houghton Mifflin Company, Boston. 432pp.

SCOTT, W.B. and E.J. CROSSMAN. 1973. Freshwater fishes of Canada. Fish. Res. Board of Canada. Bull. #184. 966pp.

Table 1.

SASKATCHEWAN FISH SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	RANKS SASK.	RANKS GLOBAL	DRAINAGE	BASIN*	
CLASS: CEPHALASPIDOMORPHI						
FAMILY: PETROMYZONTIDAE						
ICHTHYOMYZON CASTANEUS	CHESTNUT LAMPREY	S3S4	G5		HB	
CLASS: OSTEICHTHYES						
FAMILY: ACIPENSERIDAE						
ACIPENSER FULVESCENS	LAKE STURGEON	S2	G3		HB	
FAMILY: ANGUILLIDAE						
ANGUILLA ROSTRATA	AMERICAN EEL	SE	G5		HB	
FAMILY: CATOSTOMIDAE						
CARPIODES CYPRINUS	QUILLBACK	S3S4	G5		HB	
CATOSTOMUS CATOSTOMUS	LONGNOSE SUCKER	S5	G5		HB	A
CATOSTOMUS COMMERSONI	WHITE SUCKER	S5	G5	G	HB	A
CATOSTOMUS PLATYRHYNCHUS	MOUNTAIN SUCKER	S3	G5	G	HB	
ICTIOBUS CYPRINELLUS	BIGMOUTH BUFFALO	S3S4	G5		HB	
MOXOSTOMA ANISURUM	SILVER REDHORSE	S3S4	G5		HB	
MOXOSTOMA MACROLEPIDOTUM	SHORTHEAD REDHORSE	S4S5	G5	G	HB	
FAMILY: CYPRINIDAE						
CARASSIUS AURATUS	GOLDFISH	SE	G5	G	HB	
COUESIUS PLUMBEUS	LAKE CHUB	S5	G5	G	HB	A
CYPRINUS CARPIO	COMMON CARP	SE	G5	G	HB	
HYBOGNATHUS ARGYRITIS	W. SILVERY MINNOW	S3S4	G5	G	HB	

HYBOGNATHUS HANKINSONI	BRASSY MINNOW	S3S4	G5	G		
NOTEMIGONUS CRYSOLEUCAS	GOLDEN SHINER	S3S4	G5		HB	
NOTROPIS ATHERINOIDES	EMERALD SHINER	S5	G5		HB	A
NOTROPIS BLENNIUS	RIVER SHINER	S3S4	G5		HB	
NOTROPIS DORSALIS	BIGMOUTH SHINER	SP	G5	G	HB	
NOTROPIS HETERODON	BLACKCHIN SHINER	SP	G5	G	HB	
NOTROPIS HETEROLEPIS	BLACKNOSE SHINER	S4S5	G5		HB	
NOTROPIS HUDSONIUS	SPOTTAIL SHINER	S5	G5		HB	A
NOTROPIS STRAMINEUS	SAND SHINER	S3S4	G5		HB	
NOTROPIS TEXANUS	WEED SHINER	SP	G5	G		
NOTROPIS VOLUCELLUS	MIMIC SHINER	SP	G5	G	HB	
NOTROPIS MELANOSTOMUS	BLACKMOUTH SHINER	SP	G1		HB	
PHOXINUS EOS	N. REDBELLY DACE	S3S4	G5	G	HB	
PHOXINUS NEOGAEUS	FINESCALE DACE	S5	G5	G	HB	
PIMEPHALES PROMELAS	FATHEAD MINNOW	S5	G5	G	HB	A
RHINICHTHYS ATRATULUS	BLACKNOSE DACE	S3S4	G5		HB	
RHINICHTHYS CATARACTAE	LONGNOSE DACE	S5	G5	G	HB	A
SEMOTILUS ATROMACULATUS	CREEK CHUB	S3S4	G5	G	HB	
CYPRINELLA SPILOPTERA	SPOTFIN SHINER	SP	G5	G		
LUXILUS CORNUTUS	COMMON SHINER	S3S4	G5		HB	
MARGARISCUS MARGARITA	PEARL DACE	S5	G5	G	HB	A
PLATYGOBIO GRACILIS	FLATHEAD CHUB	S3S4	G5		HB	A
FAMILY: GADIDAE						
LOTA LOTA	BURBOT	S5	G5	G	HB	A
FAMILY: GASTEROSTEIDAE						
CULAEA INCONSTANS	BROOK STICKLEBACK	S5	G5	G	HB	A
PUNGITIUS PUNGITIUS	NINESPINE STICKLEBACK	S5	G5		HB	A
FAMILY: HIODONTIDAE						
HIODON ALOSOIDES	GOLDEYE	S3S4	G5	G	HB	A

HIODON TERGISUS	MOONEYE	S3	G5		HB	
FAMILY: CENTRARCHIDAE						
AMBLOPLITES RUPESTRIS	ROCK BASS	S3S4	G5		HB	
MICROPTERUS DOLOMIEU	SMALLMOUTH BASS	SE	G5		HB	
MICROPTERUS SALMOIDES	LARGEMOUTH BASS	SE	G5		HB	
FAMILY: PERCIDAE						
ETHEOSTOMA EXILE	IOWA DARTER	S5	G5	G	HB	A
ETHEOSTOMA NIGRUM	JOHNNY DARTER	S5	G5		HB	
PERCA FLAVESCENS	YELLOW PERCH	S5	G5	G	HB	A
PERCINA CAPRODES	LOGPERCH	S5	G5		HB	
PERCINA MACULATA	BLACKSIDE DARTER	S3S4	G5		HB	
PERCINA SHUMARDI	RIVER DARTER	SP	G5		HB	
STIZOSTEDION CANADENSE	SAUGER	S5	G5		HB	
STIZOSTEDION VITREUM	WALLEYE	S5	G5	G	HB	A
FAMILY: SCIAENIDAE						
APLODINOTUS GRUNNIENS	FRESHWATER DRUM	SE	G5		HB	
FAMILY: PERCOPSIDAE						
PERCOPSIS OMISCOMAYCUS	TROUT-PERCH	S5	G5		HB	A
FAMILY: ESOCIDAE						
ESOX LUCIUS	NORTHERN PIKE	S5	G5	G	HB	A
FAMILY: SALMONIDAE						
COREGONUS ARTEDI	CISCO OR LAKE HERRING	S5	G5		HB	A
COREGONUS CLUPEAFORMIS	LAKE WHITEFISH	S5	G5		HB	A
COREGONUS NIGRIPINNIS	BLACKFIN CISCO	SU	GXQ		HB	A
COREGONUS ZENITHICUS	SHORTJAW CISCO	S2S3	G3			A
ONCORHYNCHUS NERKA	SOCKEYE SALMON	SE	G5		HB	A

ONCORHYNCHUS CLARKI	CUTTHROAT TROUT	SE	G5		HB	
ONCORHYNCHUS MYKISS	RAINBOW TROUT	SE	G5	G	HB	A
PROSOPIUM CYLINDRACEUM	ROUND WHITEFISH	S5	G5		HB	A
PROSOPIUM WILLIAMSONI	MOUNTAIN WHITEFISH	SP	G5		HB	A
SALMO TRUTTA	BROWN TROUT	SE	G5	G	HB	A
SALVELINUS FONTINALIS	BROOK TROUT	SE	G5	G	HB	A
SALVELINUS NAMAYCUSH	LAKE TROUT	S5	G5		HB	A
THYMALLUS ARCTICUS	ARCTIC GRAYLING	S5	G5		HB	A
FAMILY: UMBRIDAE						
UMBRA LIMI	CENTRAL MUDMINNOW	S2S3	G5		HB	
FAMILY: COTTIDAE						
COTTUS BAIRDI	MOTTLED SCULPIN	SP	G5	G	HB	
COTTUS COGNATUS	SLIMY SCULPIN	S5	G5		HB	A
COTTUS RICEI	SPOONHEAD SCULPIN	S5	G5		HB	A
MYOXOCEPHALUS THOMPSONI	DEEPWATER SCULPIN	S5	G5		HB	A
FAMILY: ICTALURIDAE						
ICTALURUS PUNCTATUS	CHANNEL CATFISH	S1S2	G5		HB	
NOTURUS FLAVUS	STONECAT	S2S3	G5	G		
NOTURUS GYRINUS	TADPOLE MADTOM	S2S3	G5		HB	
AMEIURUS MELAS	BLACK BULLHEAD	S3S4	G5		HB	
AMEIURUS NEBULOSUS	BROWN BULLHEAD	S3	G5	G	HB	

* Drainage Basins: G = Gulf of Mexico (Missouri), HB = Hudson Bay, A = Arctic

WINTER NORTHERN LEOPARD FROGS AT CYPRESS HILLS INTER-PROVINCIAL PARK

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On December 30, 1997 the authors were participating in the Cypress Hills, Centre Block, Christmas Bird and Mammal Count. At about 1p.m. we were walking the Highland Trail to see what birds and mammals we could add to the list. On the west side of the trail loop around Lone Pine Creek, we found spring fed, open water beneath, and east of a footbridge.

The spring was nearly dry in late summer, but it began to run again late in the fall. The open water was now deep and extended about 3 m. east where ice and snow covered the surface of the beaver dammed creek. The substrate was muddy with abundant cobblestone.

We noticed several motionless Northern Leopard Frogs (*Rana pipiens*) lying spread eagle on their backs at the bottom. On closer examination we found a total of ten seemingly dead and four live Northern Leopard Frogs. The live frogs appeared to be in individual overwintering pits such as those reported by Preston ; they had their legs tucked up and were facing into the mud[3].

The live frogs moved only when touched, at which their hind limbs kicked, causing them to move further into the mud. The frogs we thought dead were not touched. No other frog species were seen, however, Brook Sticklebacks (*Culaea inconstans*),

Leopard Frog

Olaf Christian Jensen

Waterboatmen (*Corixidae*), and Backswimmers (*Notonectidae*) were moving about rather slowly in the water. Melody visited the site on January 5th and 6th, and found the live frogs had worked their way deeper into the mud. The frogs we found were not frozen but were cold enough that mobility was almost nonexistent.

On January 15th Melody made another trip to the spring and was surprised to find six Northern Leopard Frogs lying on their backs, some with their tongues

partly out and eight frogs in the tucked up posture. When one of the spread-eagled frogs was touched, it moved.

Melody collected two of the spread eagled frogs with closed mouths and put them on snow in the refrigerator to warm up a bit. One of the frogs became somewhat active, recovering the tucked up posture and moving its limbs. The other frog appeared dead, its eyes clouded and no movement was observed. These frogs were kept in a chilled condition so they could be returned to the capture site. On January 16th Jerome Schommer and Susan visited the site to return the refrigerated frogs, take photographs, and collect a frog with its mouth open and its tongue out to see if it would recover. This collected frog did not recover and we suspected it was dead.

The area of open water had expanded to about 3 m by 7 m. A total of 14 frogs were seen excluding the two returned from captivity. Six of the Northern Leopard Frogs were in the belly up, spread eagle posture, and eight were belly down, either tucked up or spread out. Three frogs were almost entirely buried in the stones. One had only its hind legs exposed, one had one hind leg exposed, and one had its head partly exposed. A couple of frogs were seen swimming slowly for about a metre.

Northern Leopard Frogs are poikilothermic ectotherms which means their body temperature changes with their environment and they obtain body heat from their environment. These animals become less able to carry out metabolic activities as temperatures drop below the optimal temperatures of 30°-40°C. Enzymatic activity is low enough when temperatures fall below 5°C that frogs stop eating. During winter, activity is frequently reduced to the point of dormancy [4].

Some species such as Wood Frogs *(Rana sylvatica)* are able to supercool their blood to prevent ice crystal formation, or to survive freezing for up to several weeks by using carbohydrates which reduce the freezing point of cells while allowing extracellular fluids to freeze[4]. Cook states that Northern Leopard Frog bodies may often be found lying on their backs on the bottom after attempting to overwinter in water with insufficient dissolved oxygen concentrations for their survival[1]. William Preston found that frozen frogs, which appear dead, have recovered upon thawing (pers. comm.).

Dr. Diane Secoy (pers. comm.) said she has seen frogs moving beneath ice. Dr. William Preston (pers. comm.) thought movement under ice was possibly to circulate water or to shake silt off their bodies for improved oxygen exchange across the skin. It is possible the frogs we saw came from sites beneath the ice to the spring fed water where oxygen levels may have been higher.

This note was written because of growing interest in amphibians and the Northern Leopard Frog in particular. Northern Leopard Frogs have experienced a serious decline in abundance and distribution since 1978[2,4]. However, in the Centre Block, populations have recovered somewhat in recent years. In the last two years, Rick Goett, Park Program Manager, reported seeing more Northern Leopard Frogs than in previous years.

The weather may have been a factor in this phenomenon. Early winter snow accumulations were below average but temperatures were near normal. Most of the 15 cm snow cover fell on December 29th. Air temperatures on January 30 ranged from +1.5°C to -0.5°C at the usual 4:30p.m. temperature recording

time on the count day. January 5 temperatures ranged from -2.5°C to -11°C. January 6 temperatures ranged from -0.5°C to -3.0°C. January 15 temperatures ranged from +3.5°C to -13.0°C. On January 16th air temperatures ranged from -1.0°C to -12.0°C with 2 mm of snow fall.

Acknowledgements

Information received from Rick Goett, Wayne Harris, Larry Helmerson, William Preston, and Diane Secoy were appreciated. Field assistance was provided by Jerome Schommer, Cypress Hills Conservation Officer.

Literature Cited

1. COOK, F.R. 1984. Introduction to Canadian Amphibians and Reptiles. National Museums of Canada. Ottawa. 200p.

2. POWELL, G.L. AND A.P. RUSSELL. 1996. Alberta's Amphibians and Reptiles: Current Research and Conservation Issues. 253-256p. *In* W.D. Willms and J.F. Dormar, eds. Proc. Of the 4th Prairie Conservation and Endangered Species Workshop. Prov. Museum Of Alberta Natural History Occas. Paper No. 23. 337p.

3. PRESTON, W.B. 1982. The Amphibians and Reptiles of Manitoba. Manitoba Museum of Man and Nature. Winnipeg. 128p.

4. RUSSELL, A.P. AND A.M. BAUER. 1993. The Amphibians and Reptiles of Alberta. University of Calgary and University of Alberta Presses. 264p.

American Bittern Ron Jensen

OBSERVATIONS OF REPTILES AND AMPHIBIANS, AND THOUGHTS ON CONSERVATION IN PRAIRIE CANADA

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The purpose of this article is to report incidental observations of reptiles and amphibians, and to place these in a human cultural context. Successful conservation strategies are deeply embedded in human beliefs and practices. The Canadian Biodiversity Strategy suggests that "...knowledge, innovations and practices of indigenous and local people should be respected."[3]

The northern Great Plains region supports few amphibians and reptiles, due to the dry and cold "continental" climate. Because of this rarity, pre-planned studies of these animals have been few. Incidental observations may be of value for assessing biodiversity. Species can be rare owing to their biological characteristics (e.g., some plants, top level predators), because they are declining, or because they are simply difficult to observe[11].

Study area and Methods.

Our observations in southeastern Alberta and southwestern Saskatchewan were derived from the memories and notes of June and Bill Picotte, memory and field notes of Joe Schmutz, and anecdotes reported to us by local people. June Picotte made her observations while she was growing up near Mendham, Saskatchewan in 1940-50, and later while she taught school in Bindloss, Alberta. She lived at the headquarters of the Remount community pasture south of Bindloss from 1959-90, near the northern edge of a large sand hill complex (Fig. 1). The pasture was used for grazing cattle during summer and early fall. This pasture was north of a 2500-km^2 military training area, Canadian Forces Base Suffield. Although parts of this region had been settled and used for farming in the early parts of this century,[22,9] this region now includes grasslands as close to "natural" as any remaining on the Canadian prairies. Joe reports observations made during a study of raptors on a study area south and east of Hanna, Alberta, 1975-77 & 1983-96[32]. In addition, observations and conversations with landowners were recorded during a survey of 80 randomly selected study plots located throughout southeastern Alberta[31].

Snake sightings

Based on our casual observations, snakes may have declined in southwestern Saskatchewan and southeastern Alberta. June recalls large, unidentified snakes (*date not given ;Ed*) with slate-blue and pink markings in a pasture and near a slough used by milk cows and horses, possibly a Red-sided Garter Snake (*Thamnophis sirtalis parietalis*). June and her siblings frequented this pasture often, enjoying abundant bird life and wild flowers.

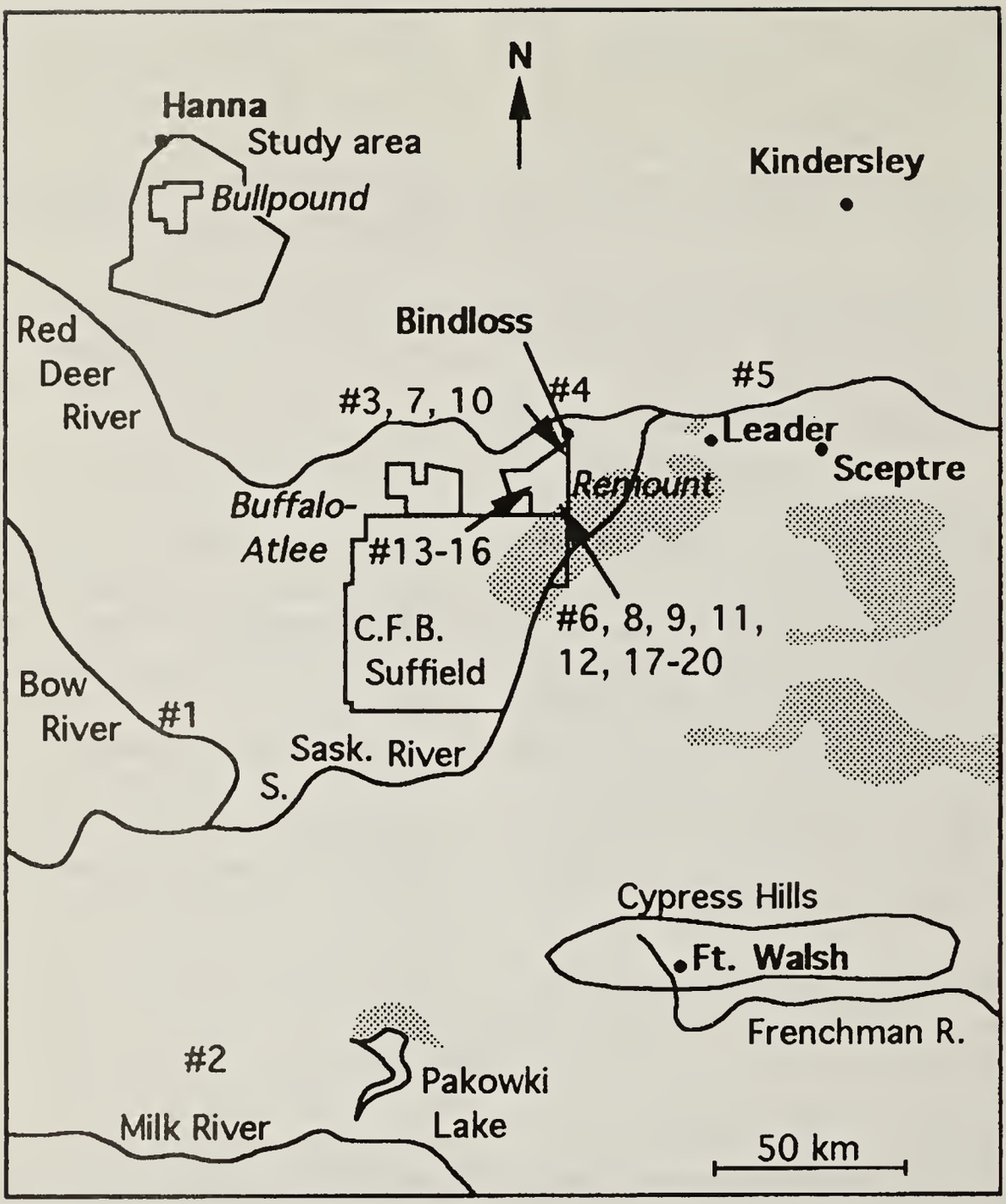


Figure 1. Locations of Buffalo-Atlee, Bullpound and Remount community pastures, administered by the Special areas Board of Hanna, Alberta. Stippled areas show sand hill complexes comprised of regosol soils.[1,33]

When teaching in Sceptre, Saskatchewan, in 1955, June and her grade I-II students examined a large garter snake, different in shape and color from the snakes of June's childhood. During the 1940s, she saw no small snakes and during the late 1940s even the large snakes seemed rare.

Rattlesnakes. In 17 years of field work in the Hanna-Sunnynook area 25-50 km from the Red Deer River (Fig. 1), no rattlesnakes (*Crotalus v. viridis*) were observed. Similarly, local residents reportedly have never seen rattlesnakes there. This confirms the edge of the rattlesnakes distribution.[38] A rattlesnake denning area (#4) visited by Dan Wood and Frank Spath was on a ledge (250 x 50 m) 40 m below the top of an eroded southeast facing tributary valley feeding southward into the Red Deer River canyon. Rattlesnakes basked on the ledge on warm days, at least in October 1990-92. On the ledge were over 100 rattlesnakes, approximately 25-120 cm in length and up to 30 snakes per cluster. In former years garter and

Bullsnakes (*Pituophis melanoleucus sayi*) were present also, but recently these may have moved to a hibernaculum nearby (Dan Wood and Frank Spath, pers. comm.).

Western Hognose Snake The Western Hognose Snake (*Heterodon nasicus*) is considered rare on the Canadian prairies.[42] In 1976, June saw her first of a total of 12 western hognose snakes (Table 1 #6). It was unlike any snake she had seen before and a field guide confirmed its identification. This snake spread its head and hissed while observed. According to Plattwho studied hognose snakes in Kansas, the snake's stereotypical defensive behavior includes a threatening phase in which the head and front 1/3 of the body are flattened and broadened[26]. The outspread scales reveal the brighter color of the interstitial skin. This can be accompanied by hissing, vibration of tail, concealment of the head under parts of body and "pseudo strikes" with mouth closed. If disturbance persists, death feigning sometimes ensues. Platt writes "When I picked up the western hognose snake, it began to hiss. I put it down and waved my hand at it. Each time my hand passed over it, it hissed and thrashed and coiled its body. It formed a round pancake coil with its head underneath and kept hissing. I kept touching it and it writhed and kept hissing. Finally, after approximately three minutes, it turned belly up, opened its mouth and quit hissing. It writhed for a few seconds. It then lay in a coil with its head on the inside, feigned death with its mouth partly open, and defecated."[26]

In spring 1977, June encountered another hognose snake (#7) that hissed while being examined. The snake could not be induced to roll over or feign dead by tossing pebbles at it.

In July 1977, June encountered a hognose snake (#8; Fig. 2). Judging from marks in the sand, the snake had apparently dislodged a buried toad (*Bufo* sp.). The toad had swelled considerably and was still alive. The snake was biting it or getting a better hold, and there was much blood. When gently prodded, the snake willingly abandoned its prey, expanded its head, hissed and then tried to escape. It did not feign death.

Figure 2. The photograph shows hognose snake #8, attempting to swallow a toad.

According to Platt, frogs and toads are a common prey of western hognose snakes, ranging from 26-36% of prey items[26] . The adaptations of hognose snakes for eating toads include expansive gape, enlarged rear maxillary teeth, and a physiological resistance to the poison produced by the skin glands of toads.[26] Hognose snakes are apparently able to scent toads buried in sand. The snakes use their upturned nasal scale for digging toads out, or for digging escape burrows in sand.
In late August or early September 1983, June and a friend spotted a small hognose snake, about 50 cm long (#10). The snake kept striking at June and her partner when disturbed.

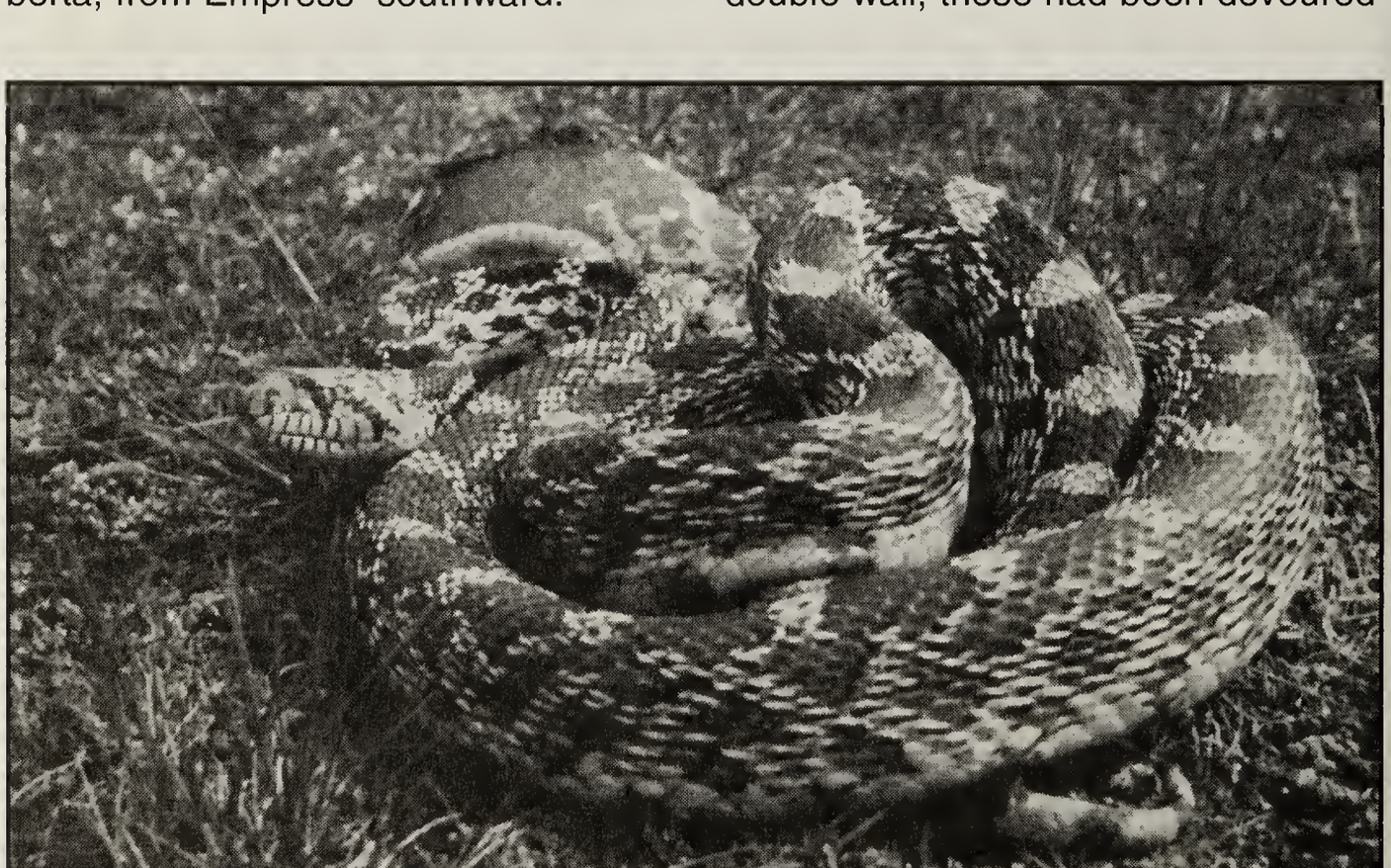
Another hognose snake (#11) did not have a good hold on a toad. Both were covered in sand from rolling. When separated from its prey, this snake also could not be induced to roll over or feign

death. Other authors, as cited in Platt, were similarly unable to entice some western hognose snakes to feign death[26]. In 1988, a hognose snake (#13) with a toad in its mouth was on the roughly graded "fire guard" on the Remount pasture. A following vehicle ran over the snake accidentally.

While visiting areas in Alberta with a record of hognose snake sightings, Smith and Wershler, in 48-person days of searching, saw no hognose snakes[34]. Live traps with a 3.7 m barrier fence set for a total of 222.5 days in 1989 on the Remount Pasture and vicinity, captured one hognose (#17). It appears that June may have seen more hognose snakes at the northern edge of the species' range in Alberta than most people. The 12 snakes which June and Bill have seen bring to 41 the total number of records known from Alberta since the 1920s[34] Pendlebury[24]. reported 14 records of Western Hognose Snakes from Alberta. All, except one disputed record near Craigmyle, were located in the extreme southeast of Alberta, from Empress southward.

Western Hognose Snakes tend to be largely active during the day, and hence poor visibility at night might not be a serious complicating factor in the rarity of observations. Leavesley found snakes in Manitoba active only on warm nights[19]. Of 17 snakes monitored, their movements between 2-11 re-locations of the same individual ranged from 200-700 m.

Bullsnake The Bullsnake was noted around ranch headquarters for its predilection to climb. One Bullsnake had climbed a garage wall and was attempting to consume a nestling Barn Swallow (*Hirundo rustica*) tail first. Two additional snakes were on the ground as were the remaining nestling swallows that ha d fluttered out of the nest. June took the three nestlings into the house until the snakes had left and these fledged successfully. On another occasion a large bull snake basked on the floor of a salt storage shed until evening. Judging from the silence of a normally noisy brood of common starlings (*Sturnus vulgaris*) inside the shed's double wall, these had been devoured



Bullsnake *Wayne Lynch*

by the snake. A third sighting of a bull snake revealed an interesting anti-predator behavior by a Nuttall's Cottontail (*Sylvilagus nuttallii*), locally known as "bushrabbit." The rabbit leapt into the air repeatedly landing on a large bullsnake, presumably attempting to divert the snake away from a nest of young rabbits. As June and Bill moved closer to investigate, both snake and rabbit fled.

Yellowbelly racer Another rare snake, the Yellowbelly Racer (*Coluber constrictor flaviventris*), "may occur in Alberta south of the Milk River and east of Coutts."[30] There are several recent reports of this species from southwestern Saskatchewan, including Grasslands National Park (Diane Secoy, pers. comm.). Dan and Gwen Wood (pers. comm.) observed an approximately 50 cm long Yellowbelly Racer 0.5 km west of Ft Walsh, Saskatchewan (Fig. 1), on 10 July 1993. Dan, who had hand caught many garter snakes before, could not catch this snake. It moved very quickly through grass. When encountering a dense stand of snowberry (*Symphoricarpos occidentalis*), it moved over top of the shrub's dense canopy and continued moving in the grass once on the other side. This snake was identical in appearance to the photograph of a racer taken by Lynch[20:109].

Unknown snakes On three different occasions, June saw snakes she could not identify. In July 1968, June encountered a dark gray or blue snake with a blunt head, about 80 cm long and moving slowly on a sandy road. In April-May 1971, while searching for arrowheads, June saw a 30 cm snake that reminded her of a "whipsnake" which she saw in a museum. In July 1972 or 1973, one snake was nearly 1 m long, silver-gray, thin and moved unusually quickly in a friend's garden, where the friend had seen smaller versions of this snake earlier that year. Although these observations are not useful from a 'posivist' perspective, the observations do suggest that more surveys or screening of local knowledge could reveal a hidden biodiversity which is missed in surveys that are necessarily limited in scope.

Frogs and toads Over the years only one toad was seen near Hanna. In contrast, toads were common on the Remount Pasture. When the porch light was on at headquarters at night, toads (Great Plains Toads *Bufo cognatus,* or Dakota Toads *B. hemiophrys*) frequented the concrete step and with rapidly darting tongues caught insects attracted to the light. Also in contrast to Hanna, frequent observations of toads in a small regosol sandhill complex in aspen parkland near Joe's home west of Saskatoon further support the apparent association between sandy habitat and high toad numbers[1].

Biodiversity

Changes in agriculture and their impact on biodiversity were as pervasive in June's youth as they are today. For instance, June's father sold the cattle the family owned in 1943 and began to grow only grain. This was the time when participation by farmers with the Canadian Wheat Board's policy for marketing grain became mandatory. Though some farmers benefited, this system was detrimental to nature conservation as a whole. Negative impacts of the Board's quota system on the prairie landscape included: encouraging excessive summer fallow, encouraging cultivation of marginal land, de-coupling marketing from the land's productivity, and disincentives that thwarted efficient production, diversification and forage production for livestock[37].

Perhaps one of the most serious errors of the past was a singular, "broadcast

type" of regional management style. Settlement, for instance, was advocated universally with little or no regard for soil type, for landscape, or rare features deserving protection. Many conservationists today feel that this mistake has been made and it is too late to change. Actually, prairie settlement by humans may be ongoing, proceeding in waves.

Perhaps the very first wave was settlement by aboriginal peoples after the glaciers retreated, then by explorers, trappers and "buffalo hunters," followed by ranchers and then farmers. The waves continued, homesteaders were replaced by mechanized agriculture, by industrial agriculture, chemical agriculture and most recently by diversification, biotechnology and corporatization in agriculture.

There is a need to consider in combination the diverse "capital" a nation has at its disposal: the capability of the land, the nature and aspirations of the people and the socioeconomic forces. These considerations are as urgent today as they were in the early days of prairie settlement. There are encouraging signs of more mature thinking today compared to the past, as reflected in the words ecosystem- or adaptive management. The future will tell how broadly and deeply these words and their actions are appropriated into our collective thinking.

Attitudes and conservation

Biodiversity conservation does not simply flow from a government building or from scientific literature, it requires the participation of people. This participation in turn is strongly influenced by what people believe or value. Human attitudes do not universally favor snakes. Joe has to force himself to overcome a deep seated fear of snakes. Snakes are frequent among roadkills (pers. observations), and it is likely that many deaths are deliberate.

June's father knew about hognose snakes; local residents called them "puff adders." A story circulated about a person fishing near the South Saskatchewan River who fell asleep as a result of the puff adder's breath.

In June's youth, children were cautioned against and hence fearful of rattlesnakes. June herself grew up fearing rattlesnakes. When she married, her new home was at Bindloss in the Alberta sand hills (Fig. 1), an area well known for its many rattlesnakes. June feared for her two children but this fear was lessened when a neighbor reassured her that no child had ever been bitten by a rattlesnake in the Bindloss area (Fig. 1). As far as June knows, this still holds true today. This local knowledge about the danger of snakes, was likely much more influential than any policy or law could have been.

A horse, bitten on the nose by a rattlesnake, breathed with difficulty. Its head was swollen and green colored mucus oozing from the nostrils but it survived. The symptoms are consistent with the physiological effects of rattlesnake venom, including leakage of blood plasma and a lowering of breathing rate[8]. The lethal capacity of the venom of the prairie rattlesnake (*C. v. viridis*) ranks 20th of 22 species/subspecies reported, behind the only other subspecies (*C. v. oreganus*) that occurs in Canada (interior BC., 17 of 22[8]).

The effectiveness of any effort to protect snakes will depend on the degree of perceived or real danger to humans and livestock which rattlesnakes present. Even harmless snakes may suffer because people may be unwilling or unable to discriminate. A tolerance of, or even fondness for, rattle-

snakes is not uncommon among farmers and ranchers who perceived that the snakes reduce rodent numbers. This component of local knowledge is clearly of immense value in snake conservation. This serves as an example of how local knowledge may be effectively built upon for conservation.

In conversation with landowners and lessees during a raptor survey in 1982, Jack Ross, residing south of the Milk River, reported that on one part of the ranch he commonly saw ground squirrels (*Spermophilus sp.*) but no snakes[31]. In the early 1980s, there were snakes but no ground squirrels. The rancher acknowledged that dog and stock suffered from an occasional bite, but even the cattle dog survived this. A farmer, north of the Milk River reflected that in eight years he had seen only two ground squirrels, and he attributed this to the presence of rattlesnakes. June has observed a rattlesnake swallowing a ground squirrel outside of a burrow (#3, Table 1).

In some respects, biodiversity conservation on the prairies is another source for urban-rural conflict[28]. The problems Canada has encountered with the proposed endangered species legislation reflects at least in part a perceived and/or real misalignment in public administration. The perception is that environmentalists armed with the power of science and government, are threatening a livelihood that has a tradition in Canada,albeit a short one[40]. Local land users may underestimate the urgency of protection for an ecosystem which they experience on a daily basis.

On 16 July 1997, the Biology Department, University of Saskatchewan received a call from a farmer near Eatonia. A rattlesnake had been seen on the driveway of a farm where children resided. The call was for advice on how to respond, what precautions to take and what treatment was called for in the case of a bite. Living with snakes, clearly requires a lifestyle adjustment. How does the environmental impact of a snake killed on the farm compare with the use of insecticides to kill mosquitoes in cities?

Local and other forms of knowledge

In 1963-64 a pipeline along the northern edge of the sand hills complex was added to an existing line built in 1958. Work started about 6 km from ranch head quarters in May 1963. Snakes were moving then, north and west as they did each year, coming from their dens along the South Saskatchewan River. If the snakes fell into the pipeline trench they often hid under the pipe. To allay the workers' fears one employee was appointed snake killer. In one instance Bill Picotte counted eight dead snakes along a 1.6 km segment. During that summer and fall, ranch headquarters was "overrun" with mice. When children wandered in and out of the house without closing the door, mice came in. Bill Picotte hung his saddle from the roof of the barn to protect it from mice gnawing on the leather or building nests in the saddle bags. It was then that June came to appreciate rattlesnakes. To the people who lived in the area and knew snakes as predators of mice, the connection between snake deaths and the rodent outbreak seemed obvious, even if this apparent correlation did not necessarily reflect cause and effect.

The hognose snake observations of June and Bill are valuable in themselves given their rarity. According to the biological literature, mating and courtship of the hognose snake had not been observed until very recently[27]. On critical examination this statement may reflect an over-reliance on formally recorded "scientific" knowledge. It is pos-

sible that this knowledge of mating was embedded in local knowledge long ago. It may be fruitful to find ways to encourage local knowledge to cross into the realm of formally recorded biological knowledge more frequently than is happening now[16].

The Remount community pasture owes its existence in part to traditional knowledge. Jordan provides evidence to suggest that the open range herding of beef cattle originated first in the Eastern Hemisphere, was later prominently practiced on the Atlantic fringe of Europe and Africa, and moved from the Iberian peninsula to the New World[15]. Early mounted vaqueros used a spear to prod cattle and the use of rope with saddle horn may have been a New World innovation. Although the "open-range cattle-ranching strategy invariably caused habitat modification and damage, this was due to mismanagement and excessive grazing pressure (e.g.,[7])"[15]. The grasslands of the Buffalo-Atlee and Remount community pastures, in contrast, have been maintained at a stocking rate of five and six animal unit months per acre (0.4 ha), respectively, during the summer months (cf.[43]). Range condition in both pastures was variable, ranked fair to excellent depending on distance to drinking water (Lorne Cole, pers. comm.). The diversity of range condition also leads to a diversity of animal consumers with some species occupying sparsely vegetated areas (e.g., Horned Larks *Eremophila alpestris,* deer mice *Peromyscus* sp. and grasshoppers; and other species residing in moderately dense vegetation [e.g., voles])[41,6].

Land users are frequently offended by the top-down and outside intervention they experience. Many incorporate in their own daily struggle their personal brand of conservation, encouraged by an ethical judgment that in turn is informed largely through local and traditional knowledge. This is rarely fully recognized, nor are many public administrators sufficiently educated in commumity psychology. For instance, spurred by a sense of protection Frank Spath was cautious when revealing the location of rattlesnake hibernacula. Bill Picotte, took a firm stance risking his position as pasture manager against calls to increase stocking rate on the Remount community pasture. A sense of protection for the grassland community that sustains them (e.g.,[5]), is exhibited by many ranchers. This form of "social capital" may be as requisite for protection as the natural elements deemed threatened.

Given the widely acknowledged "biodiversity crisis' in prairie Canada and given the pressing question of whether the soil-life support system can be sustained throughout the prairies (e.g.,.[2]), it is urgent for biologists to help build solutions. The biological science agenda can have diverse goals that should be critically articulated for effective solution-building. Holton identified the "sociological setting" where conclusions are proposed for acceptance by other scientists ("invisible college"[44]), and the "cultural setting" where goals respond to a society's needs[13]. Conservationists might be urged to step beyond the context of traditional disciplinary knowledge and appropriate other ways of knowing, consider the social context within which science operates, and become familiar with other forces in society (natural, economic and social capital; Fig. 3). Weeks and Packard concluded that holistic management in a ranching and fisheries setting was impeded by miscommunication between scientists and user groups, by an inability by resource users to built trust with agency personnel due to frequent change in personnel, and by an inappropriate re

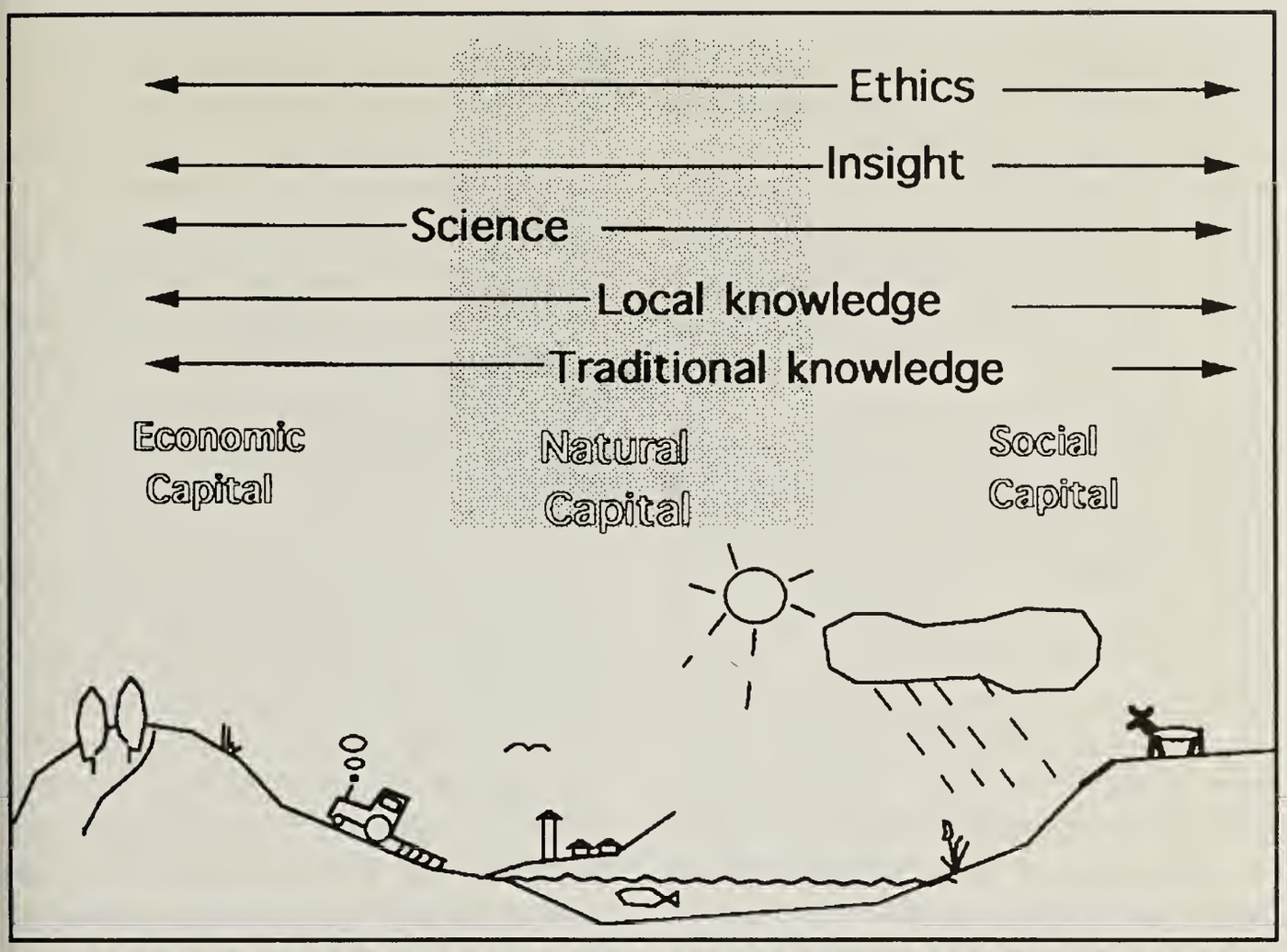


Figure 3. The conceptual diagram is intended to suggest that three types of resources or "capital" impinge on ecosystems in a co-evolutionary sense. For effective conservation, conservationists may need to become familiar with all three spheres, and appropriate diverse forms of knowledge beyond the substantive aspects of traditional biological science.

lationship between scientific and local knowledge[39].

In our age of information overload and increasing specialization, it may be unrealistic for any one person to be equally well versed in economics and biology. Instead, a key solution may lie in cooperation and team work. For this to happen, dismantling the prevailing barriers between disciplines and reducing the chauvinism among types of knowledge may be an important first step.

Protecting the snake's ecosystem

Any coordinated attempt to conserve biodiversity will soon beg the perplexing questions of what manner of natural state deserves to be conserved (cf.,[14]), over how large an area, and what conservation state is actually achievable in the long term[29]. Apparently, the highest level of protection and management can be achieved by most nations for only a small portion of the land. There are several difficulties associated with a static view of the "fortress" type of protection for an ecosystem alluded to here[25]. The grassland ecosystem owes its existence to a state of flux involving fire, and large and small grazers, whose ecology has been greatly altered. For meaningful protection for biodiversity and ecosystem health over areas large enough to entail functioning landscape-level processes, a ranching economy can be an important if not essential ally in prairie Canada. This is particularly true if this economy functions according to recognized range management principles,

including: the balancing of animals and forage supply, approximating uniform livestock distribution, alternating grazing with rest, using livestock that suit forage supply and management objectives, and the recognition that physical factors, animals, and plants combined, act as an interdependent unit whose functioning can be disrupted[43]. An urgent need clearly still exists to protect with a "fortress strategy" particular features in small areas specifically for biodiversity and ecosystem health values. However, an appropriately managed traditional ranching economy can be importantly placed within a continuum of protection objectives: from the highest level of protection on small parcels of land to the moderate protection on a "working ranch" and finally to minimal protection in areas of industrial agriculture and other resource extraction. A traditional ranch can assist in the protection of "big space."

Two illustrations of a dilemma inherent in protecting portions of an ecosystem arose from the Middle Sand Hills, immediately south of the Remount community pasture (Fig. 1). In a quasi-natural state, feral horses roamed free in a military reserve. They degraded their favorite portions of the sand hill habitat so severely that they were removed (Gary Trottier, pers. comm.). In contrast, with continued management as in the past, the Remount pasture immediately to the North stands to serve ranchers and biodiversity conservation well. The Remount pasture is a "B-level" candidate for Alberta's Special Places[4]. However, it is unlikely that this small change in administrative status will affect the future of this "working ecosystem" significantly.

The value of the unique natural communities contained within the Canadian Forces Base Suffield, the Middle Sand Hills along the South Saskatchewan River and the mixed grasslands to the southwest, has been recognized. An Order-in-Council, signed by the Ministers of the Department of Defense and the Department of Environment on 11 March 1992, designated joint management responsibilities for this 45,870 ha area. It also designates the affected lands as a National Wildlife Area in the event that the Department of Defense should relinquish ownership in the future.

In some respects, range management on the Remount pasture and parts of the Middle Sand Hills have allowed grasses to fare too well. At least two plant species considered threatened in Canada (Sand Verbena *Abronia micrantha* and the Western Spiderwort *Tradescantia occidentalis*) have lost habitat because active dunes have stabilized, apparently in response to "good" range management[35,36]. Wallis and Wershler (in[35]) state that "Ironically, stabilization of active sand [in Nebraska] was seen as a good conservation practice. Land managers went to great lengths to stabilize active blowouts, extinguishing fires, modifying their grazing patterns and even placing old tires in the blowouts." It appears that a single-goal state for an ecosystem cannot be chosen easily from first principles. It may be fruitful to allow local conditions, local practices and traditional knowledge to help create some of the diversity which no doubt existed in the past.

Conservation and production

Some conservation action is achieved through spin-off benefit, such as the operation of a community pasture according to traditional and local knowledge. In addition, spin-offs arise from the personal/ethical compassion for a natural system whose "glory exceeds that of ours."[12] Frank Spath and his family living close to so many dangerous

snakes took an adjustment in lifestyle, a continual awareness and caution. Bill Picotte and Butala took some personal risks not so much to advance the cause of the hognose snake or Sprague's pipit (*Anthus spragueii*), but more likely because they felt that a portion of an ecosystem was "entrusted to their care."[5,21] Greg Gordon (JKS pers. comm.) found the strip mining near his ranch, even with state of the art reclamation, an appalling intervention in a landscape. When confronted with the question of how an agricultural producer might balance economic losses with biodiversity values as in the case of his ranch, Francis Gardner (JKS pers. comm.) advanced, akin to "new age" deep ecologists, that a tolerance for "pest" species requires an appropriate connection to nature. This is relevant to ground squirrel management in Canada. These rodents are a "keystone species" on the one hand, and considered an agricultural pest on the other. Their survival locally depends on the tolerance by agricultural producers. Although a sensible word view is no absolute guarantee for socially and environmentally responsible action some world views are more promising than others[10]. How do such world views arise? How can they be influenced?

A regulatory mechanism for conservation is clearly required, in addition to individual stewardship. Economic instruments, when creatively applied as in a co-evolutionary, co-dependent sense, are additional avenues to enhance conservation[18]. In the case of the quota system (see above) the failure is reminiscent of single-capital (Fig. 3) administrative thinking. Recently, an opportunity may have been missed to rectify this, at least in part, through economic instruments. Following the cancellation of the "Crow Rate" transportation subsidies (c.f.[17]), a "payout" was made to landowners. This payout might have been tied to changes in practices that enhance sustainability and biodiversity. This illustrates another reason for the urgent need to not only consider different ways of knowing but also to bring together different disciplines with a systems perspective (e.g.[23]) toward administration.

Acknowledgments

We gratefully acknowledge the constructive comments provided on earlier versions of this manuscript by Andy B. Didiuk, Diane M. Secoy, Cliff Wallis and C. Stuart Houston.

Literature Cited

1. ACTON, D.F., G.A. PADBURY, and J.A. SHIELDS. 1992. Soil landscapes of Canada: Saskatchewan. Publication 5243/B, Contribution No. 87-45, Center for Land and Biological Resources Research, Agriculture Canada, Ottawa, ON. 1 map.

2. ANDERSON, DARWIN J. , C.J. ROPPEL, and R.M. GRAY. 1991. Sustainability in Canadian agriculture. Science Council of Canada, Ottawa, ON.

3. ANONYMOUS. 1995a. Canadian biodiversity strategy: Canada's response to the Convention on Biological Diversity. Minister of Supply and Services Canada, Environment Canada, Ottawa. 77 pages.

4. ANONYMOUS. 1995b. Special places 2000: Alberta's natural heritage. Alberta Environmental Protection, Edmonton. 10 pages.

5. BUTALA, S. 1997. The Old Man on his Back Prairie and Heritage Conservation Area. *Blue Jay* 55:193-195.

6. CLAYTON, K.M. 1997. Post-fledging ecology of burrowing owls in Alberta and Saskatchewan: Their dispersal,

survival, habitat use and diet. M.Sc. thesis, Dept. of Biology, Univ. of Saskatchewan, SK. 64 pages.

7. FLEISCHNER, T.L. 1994. Ecological costs of livestock grazing in western North America. *Conservation Biology* 8:629-644.

8. GLENN, J.L., and R.C. STRAIGHT. 1982. The rattlesnakes and their venom yield and lethal toxicity. Pp. 3-119 in A.T. Tu (Ed.), Rattlesnake venoms: Their actions and treatment. Marcel Dekker Inc., New York.

9. GORMAN, J. 1988. A land reclaimed: A story of the Special Areas of Alberta. Gorman and Gorman Ltd., Hanna, AB. 185 pages.

10. Hanson, L. 1995. Turning rivals into allies: understanding the wise use movement. *Alternatives* 21:26-31.

11. HARPER, J.L. 1981. The meaning of rarity. Pages 189-203 in H. Synge (Ed.), The biological aspects of rare plant conservation. John Wiley and Sons, New York.

12. HIGHLEY, B., and I. TYSON. 1991. Home on the range. Eastern Slopes Records, High River, AB.

13. HOLTON, G. 1978. The scientific imagination: Case studies. Cambridge University Press, New York. 382 pages.

14. HUNTER, M. Jr. 1996. Benchmarks for managing ecosystems: Are human activities natural. *Conservation Biology* 10:695-697.

15. JORDAN, T.G. 1993. North American cattle-ranching frontiers: Origins, diffusions and, differentiation. University of New Mexico Press, Albuquerque, NM. 439 pages.

16. JORDHEIM, S. 1997. The demise of the domestic gander. *Blue Jay* 55:204-206.

17. KLEIN, K.K., and W.A. KERR. 1996. The Crow Rate Issue: A Retrospective on the Contributions of the Agricultultural Economics Profession in Canada. *Canadian Journal of Agricultural Economics* 44:1-18.

18. VAN KOOTEN, G.C. 1993. Land resource economics and sustainable development. Univ. of British Columbia Press, Vancouver, BC.

19. LEAVESLEY, L.K. 1987. Natural history and thermal relations of the western hognose snake (*Heterodon nasicus nasicus*) in southwestern Manitoba. M.Sc. thesis, University of Manitoba, Winnipeg, MB.

20. LYNCH, W. 1984. Married to the wind. Whitecap Books, Vancouver, BC. 166 pages.

21. MACEWAN, G. 1986. Entrusted to my care: Safeguarding Canada's resources - our responsibility to the future. Western Producer Prairie Books, Saskatoon, SK.

22. MARTY, S. 1995. Leaning on the wind: Under the spell of the great Chinook. HarperCollins Publ. Ltd., Toronto. 317 pages.

23. NICHOLAS, J.M. 1990. Managing business and engineering projects: Concepts and implementation. Prentice-Hall, Englewood, NJ.

24. PENDLEBURY, G.B. 1976. The western hognose snake, *Heterodon nasicus nasicus*, in Alberta. *Canadian Field-Naturalist* 90:416-422.

25. PICKETT, S.T.A., V.T. PARKER, and P.L. FIEDLER. 1992. The new paradigms in ecology: Implications for con-

servation biology above the species level. Pp. 65-88 in P.L. Fiedler and S.K. Jain, Eds. Conservation biology: The theory and practice of nature conservation, preservation and management. Chapman and Hall, New York. 507 pages.

26. PLATT, D.R. 1969. Natural history of the hognose snakes *Heterodon platyrhinos* and *Heterodon nasicus*. University of Kansas Publications, Museum of Natural History 18(4):253-420.

27. PLUMMER, M. V., and N.E. MILLS. 1996. Observations on trailing and mating behaviors in hognose snakes (*Heterodon platirhinos*). *Journal of Herpetology* 30:80-82.

28. ROWE, J.S. 1990. Home place. NeWest Publishers Ltd., Edmonton.

29. ROWE, J.S. 1997. The necessity of protecting ecoscapes. *Global Biodiversity* 7(2):9-12.

30. RUSSELL, A.P., and A.M. BAUER. 1993. The amphibians and reptiles of Alberta. University of Calgary Press, Calgary, Alberta.

31. SCHMUTZ, J.K. 1984. Ferruginous and Swainson's hawk abundance and distribution in relation to land use in southeastern Alberta. *J. Wildl. Manage.* 48: 1180-1187.

32. SCHMUTZ, J. K., S.M. SCHMUTZ, and D.A. BOAG. 1980. Coexistence among three species of prairie hawks (*Buteo* spp.) in the prairie-parkland ecotone of southeastern Alberta. *Can. J. Zool.* 58:1075-1089.

33. SHIELDS, J.A., and J.D. LINDSAY. 1988. Soil landscapes of Canada: Alberta. Publication 5237/B, Contribution No. 87-02, Land Resource Research Center, Agriculture Canada, Ottawa. 1 map.

34. SMITH, W., and C. WERSHLER. 1989. Pilot project on the study of the western hognose snake in Alberta. Unpublished report prepared for Alberta Forestry, Lands and Wildlife by Sweetgrass Consultants Ltd.

35. SMITH, B., and C. BRADLEY. 1990a. Status report on the sand verbena *Abronia micrantha* Torr. Prepared for the Committee on the Status of Endangered Wildlife in Canada, Ottawa, Canada, 36 pp.

36. SMITH, B., and C. BRADLEy. 1990b. Status report on the western spiderwort *Tradescantia occidentalis* (Britt.) Smyth. Prepared for the Committee on the Status of Endangered Wildlife in Canada, 65 pp.

37. THORNTON, F., J. BOWMAN and D. STRUTHERS. 1993. Agricultural policy review part 2: Wheat Board quota system. *Blue Jay* 51:65-71

38. WATSON, S. M. , and A. P. RUSSELL. 1997. Status of the Prairie Rattlesnake (*Crotalus viridis viridis*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Alberta Wildlife Status Report No. 6, Edmonton, AB.

39. WEEKS, P. and J. M. PACKARD. 1997. Acceptance of scientific management by natural resource dependent communities. *Conservation Biology* 11:236-245.

40. WESTERN STOCK GROWERS' ASSOCIATION. 1995. Western Stock Growers' Association response to "A national approach to endangered species conservation in Canada." Calgary, AB. 24 manuscript pages.

41. WILSON, S.D., and J.W. BELCHER. 1989. Plant and bird communities of native prairie and introduced Eurasian

vegetation in Manitoba, Canada. *Conservation Biology* 3: 39-44.

42. WRIGHT, J. 1998. Status of the Plains Hognose Snake (*Heterodon nasicus nasicus*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, and Alberta Conservation Association, Wildlife Status Report No. 15, Edmonton, AB.

43. WROE, R.A., S. SMOLIAK, B.W. ADAMS, W.D. WILMS, and M. L. ANDERSON. 1988. Guide to range condition and stocking rates for Alberta grasslands, Alberta Agriculture, Lacombe, Alberta. 33 pages.

44. ZIMAN, J. 1984. An introduction to science studies. Cambridge University Press, New York. 203 pages.

Western Grebes - Crow Indian Lake, AB *Teresa Dolman*

WESTERN PAINTED TURTLE HATCHLINGS OVERWINTERING IN MANITOBA NESTS

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Manitoba's two turtle species, the **western painted turtle** and the **common snapping turtle,** reach the northern limits of their ranges in southern Manitoba. Adults of both species normally winter on the bottoms of ponds and rivers[2]. The females of both species lay their eggs in holes (nests) in the ground which they excavate in late spring (June). The eggs, incubated by the sun, hatch in the fall. One adaptation to cold climates is the turtle's ability to produce extra-cellular antifreeze which allows them to survive below freezing temperatures[3]. Another adaptation, recognized in other northern parts of their range, is the ability of turtle hatchlings to remain in the nest over winter before making their way to water the following spring[4]. While this overwintering behaviour has been documented elsewhere in the turtle's range, it has not been recognized in Manitoba or on the Canadian prairies.

The fact that young turtles overwinter in the nest was made clear to me when Doug Collicutt and I collected western painted turtle eggs for Dr. Ken Storey, a cryogenics (freeze tolerance) researcher from Carlton University, Ottawa. In early July 1989, we dug up some 127 painted turtle eggs from nine roadside nests in Turtle Mountain Provincial Park near Boissevain, Manitoba. We carefully placed the eggs in layers of sand in a plastic pail and transported them to Winnipeg. We dug the pail into a full sun portion of Doug's driveway and covered the top with screen to prevent predation. On 10 October, 1989 we uncovered the pail to check on the hatchlings. Over 100 had hatched (Fig. 1). Each young turtle had a large egg sac attached. The ten hatchlings that we attempted to keep in an aquarium refused to eat and died within a few weeks. The remainder went to Dr. Storey where they were processed for freeze tolerance experiments[3].

As a Nongame Biologist for over 20 years, I have received dozens of calls from cottage owners (Whiteshell, Turtle Mountains, Spruce Woods, Assiniboine River, etc.) who had found young turtles while raking leaves in the spring. I have also told people who had found turtle nests to cover them with wire mesh as a guard against predation, then to remove the cover the following spring. I did not realize that the spring emergence of young turtles that had hatched the previous fall was in question as being the Manitoba norm.

Most recently, on 9 May, 1998, Walter Smilinsky was digging dandelions in the back yard of his cottage at Brereton Lake in the Whiteshell Provincial Park, MB, when he spotted a tiny hatchling painted turtle on the ground some 30 metres from the water's edge. Walter picked it up and put it into Brereton Lake where it swam around and came up for air a number of times before moving out of sight. A day or so later I was talking to C.C. Dixon, a former Wildlife Biologist with the Province of Manitoba, now living near Boissevain Manitoba. He stated that he had just talked to a cot-

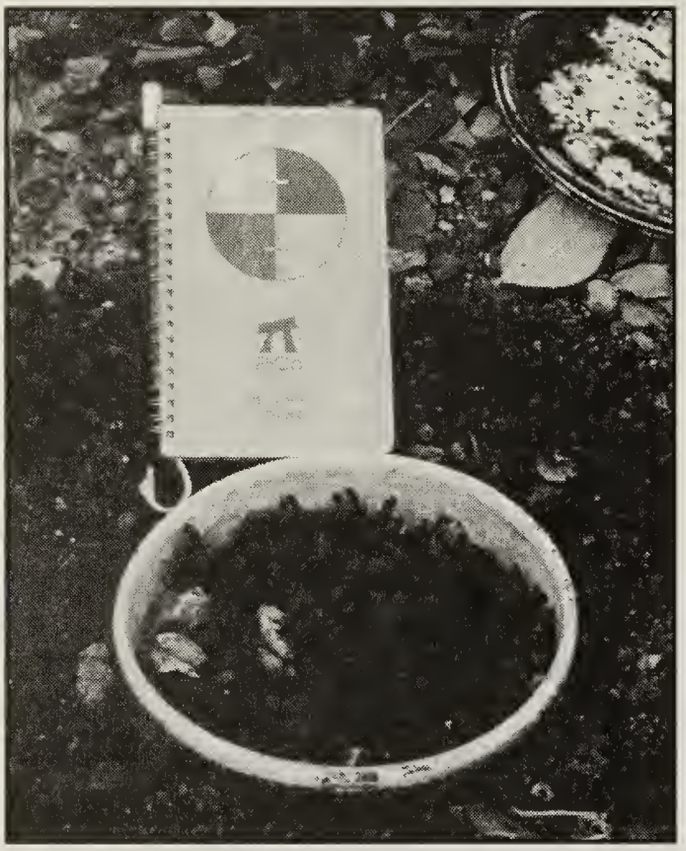

Figure 1 *W.H. Koonz*

tage owner who had discovered dozens of western painted turtle hatchlings near their cottage on Arbour Island in Max Lake (Turtle Mountain Provincial Park).

After listening to these turtle stories, I contacted Dr. Bill Preston, herpetologist at the Manitoba Museum. Bill informed me that there has been only anecdotal information from Manitoba on the documentation of young painted and snapping turtle nestlings overwintering in their nests. In Dr. Preston's book "The Amphibians and Reptiles of Manitoba"[2], he quotes a South Dakota study by Hammer which claims that common snapping turtle hatchlings would die (due to freezing) if they did not emerge from their nests prior to freeze-up in the fall[1]. On the other hand, Yntema suggests that heat may be produced by the developing embryos/hatchlings, thus enabling them to survive the winter[5]. Regarding western painted turtles, Preston quotes Woolverton who studied painted turtle nests and turtle hatchling emerging dates in a northern Minnesota study[4]. He found that many of the hatchlings from one year did not emerge from their nests until as late as mid-June the following year. Woolverton recorded temperatures in live painted turtle nests as low as -11°C. Since many of Manitoba's turtle nests are along the edges of gravel roads, winter nest temperatures could also be well below freezing.

It is hoped that this note will trigger further Canadian prairie turtle nest studies, particularly common snapping turtles, to determine if young turtles emerge in the fall or if they normally overwinter in their nests. If they overwinter in their nests, more work needs to be undertaken to determine how these hatchlings are able to survive the subfreezing temperatures which must occur in their nests.

I wish to acknowledge Dr. Jim Duncan and Dr. R.W. Nero (MB. DNR) for their manuscript ideas and for editing the text.

1. HAMMER, D.A. 1969. Parameters of a marsh snapping turtle population, Lacreek Refuge, Southakota. *J. Wildl. Mgmt.* 33(4):995-1005.

2. PRESTON, W.B. 1982. The amphibians and reptiles of Manitoba. The Manitoba Museum of Man and Nature. Wpg., MB. ISBN 0-920704-13-1.

3. STOREY, K.B., MCDONALD, D.G., DURMAN, J.G., and STOREY, J.M. 1991. Blood chemistry and ice nucleating activity in hatchling painted turtles. *Cryo Lett.* 12, 351-358.

4. WOOLVERTON, E. 1963. Winter survival of hatchling painted turtles in northern Minnesota. *Copeia,* 1963(3):569-570.

5. YNTEMA, C.L. 1978. Incubation times for eggs of the turtle *Chelydra serpentina* (Testudines; Chelydridae) at various temperatures. *Herpetologica*, 34(3):274-277.

HABITAT AND MANAGEMENT

THE MYTH OF FIRE

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The idea that fire has a cleansing and renewing value long predates written western history. The symbol of the phoenix, a mythical bird which in old age returns to its nest and creates a conflagration from which a young bird arises, is found in ancient texts from Egypt, India, China, and Arabia. In the Western Judeo-Christian tradition, the idea of fire introduced or informed many of the allegories of resurrection. For example, according to the Torah, or Old Testament, humankind was to experience a second, fiery cleansing before the final resurrection. Further, the practice of burning at the stake so popular in the correction and punishment of heretics and witches in Christian Europe was justified by the idea that their corruption could only be cleansed by fire, an action which enabled the soul to be reborn. Professor Northrup Fry has pointed out how corruption, cleansing and renewal are the common sequential elements in all such fiery myths.

We present this brief analysis of the myth of fire to demonstrate the power and ancient roots of its modern incarnation as a Kuhnian paradigm for understanding the ecology of the boreal forest. Kuhn suggests that science creates paradigms which drive and order research, and that the paradigms change only when the drive for evidence to sustain them produces so much contrary evidence that the paradigm cannot be sustained. This, he argues, is a slow process because the paradigm to a greater or lesser degree both directs the search for, and defines the nature of, evidence. How much more powerful such a paradigm must be if it is also based on one of our cultures most ancient and powerful myths.

The fire paradigm structures our thought about the boreal forest in three principle ways. First, it creates an assumption for an inherent, potential need for cleansing by fire as the inevitable outcome of aging, decay, infection, or for filing away from a predetermined norm. Second, the paradigm precludes seeing fiery cleansing apart from decay, or renewal apart from fiery cleansing. Third, the paradigm locates the search for evidence of any and all natural processes within itself, e.g. fluctuations in populations of passerine songbirds in the boreal forest must be related to fire frequency.

It is our contention that the idea of fire as the necessary cleansing agent of the boreal forest has become a Kuhnian paradigm which seeks to justify itself by directing research and defining evidence. We will establish this by presenting evidence which suggests that other growth and regenerative processes in the forest exist but are being ignored because the fire paradigm operates to insure that only data which support (or are made to support) the fire paradigm are considered. We conclude by speculating on the possibility that this paradigm is malign because it encourages human actions which are, in fact, detrimental to the survival of the boreal for-

est. We make no claim as to the role of fire on any other landscape but the boreal forest.

It is a given that organisms are born, age, and die. What is not a given is that senescence, old age, decay, or any such condition, is necessary for the reproduction of all or even a majority of the species of the boreal forest, or for the reproduction of the forest itself as a whole. The five high-trunked coniferous trees which form a large part of the biomass of the boreal forest—white spruce (*Picea glauca*), black spruce (*Picea mariana*), jack pine (*Pinus banksiana*), balsam fir (*Abies balsamea*), and tamarack (*Larix laricina*)— produce seed throughout their long life spans. We know from scientific observation that these seeds germinate and grow under ecologically limited conditions. Thus, the seeds which succeed in becoming reproductive trees are doubly limited. However, scientific observation also shows that in a non-managed forest sufficient numbers of seeds do succeed to insure that it is nowhere demonstrable that any tree species are disappearing or that the seedlings that survive to maturity come from any particular age or other class within the species. What has also been demonstrated is that many of the seeds which germinate and the seedlings which survive are able to do so because of traumas suffered by those organic components of the forest which impose the limits on the seeds' reproductive success. Contrary to the predictions of the fire paradigm, these traumas are of many sorts and may affect trees of any age. Further, while disease, predation, wind, water, foresters, and fire are all such traumas, of these only some forms of disease are commonly associated with senescence and decay.

Much of the discussion on the boreal forest uses terms like "overmature stands," "senescent stands," "disease-prone trees," and "fire-prone stands". All of these phrases describe the forest in terms of problems requiring cleansing by fire. Yet the outline of reproductive success given in the previous paragraph does not indicate that survival of the species is necessarily dependent on fire or that traumas which encourage species survival are necessarily cleansing. Rather, the controlling fire paradigm demands that emphasis be placed on the need for cleansing and so all boreal processes are interpreted as being linked to cleansing by fire. For example, deaths of trees due to agents other than fire are not seen as parts of non-fire processes. Instead, the phenomena of dying trees is labelled as a universal process of "fuel-loading," a sub-process of the fire paradigm.

The fire paradigm thus creates its own facts in support of itself. The literature on the role of fire in the boreal forest, gratuitously written by the large number of forest professionals who plan to use (or mimic) fire as a tool in forest management, makes it clear that fire is the essential cleansing agent in the forest. Yet, apart from an evangelical desire to conform to mythic content, it is not clear why fire should be singled out for this role. Despite the fact that a body of literature exists which demonstrates that bronze bore, spruce budworms, and aspen tortix also create a widespread devastation of trees which also leads to forest growth, there is as yet no appreciable amount of literature elevating these processes to mythical status.

The fire myth holds that renewal by fire is the pathway to health and continuity in the boreal forest. A host of studies presently being done illustrate that a confirmation of this role for fire is being ardently sought. The primary purpose of these studies is to establish a cycle of fire frequency which can be

usually linked to species diversity. While these studies are basically designed to provide and understanding of the fire driven process of regrowth, a common second objective is to establish an understanding of the "natural" fire-induced process against which other, anthropogenic processes such as forest culling and replanting can be judged. The assumption is that such a comparison will permit the development of forestry techniques which closely mimic the "natural" impact of fire and, therefore, will assure the best regeneration process.

We think it evident from the above the fire paradigm is driving the search for explanations of processes in the boreal forest, and that this paradigm has all the components of the ancient phoenix myth—inherent decay requiring cleansing, a single focal cleansing agent, and renewal dependent upon cleansing. But is fire such a dominating process?

For a fire to traumatize the boreal forest it must go through three stages: ignition, continuous combustion, and spread. The ignition source in the vast majority of boreal forest fires is lightning, yet the ratio of ignitions to strikes is so low that other conditions must be responsible for fire location. These other factors are heat, dryness, and fuel availability. Heat alone can produce dryness, but maximum dryness is associated with desiccating winds which occur most commonly where sharp contrasts in surface heating exist. This condition occurs most frequently along the edges of forest stands where the full canopy decreases through an area of increased stem density to a treeless area.

To spread after ignition, the fire must have fuel, must be fed massive amounts of oxygen, and of course, must not be extinguished. Where are these circumstances most commonly found? The optimum condition prevails where a relatively recent trauma has created a medium-sized opening in the forest canopy, i.e., an opening greater than 30 and less than 500 meters in width, and where the trauma has left dead trees along the forest edge. Such dry fuel is most available from medium-aged forests, where mortality has worked on a high adolescent stem density to produce a significant number of dead fallen and leaning trees. As the boreal forest grows and ages, it becomes damper, looses much of its "fuel-loading", and becomes more diverse as fallen trees create openings in which new growth occurs. It can be argued that the natural process in the forest both minimizes the effects of fire by achieving these fire retardant qualities of age, and works towards biodiversity through spot regeneration.

So what processes create enough edge effect for fires to ignite, burn, and create wide spread trauma? The resounding answer to this is—human caused trauma, and fire itself. In other words, for building and clearing create fire-prone edges which enable the high number of fires which in turn create more edges which create the conditions for more fires. If this evidence is viewed objectively, it might suggest that it has been human incursion into the boreal forest which encourages ignition and spread of fires, that the resulting fires themselves created the possibilities for further fires, and that continued human incursion encourages the maintenance of the fire cycle in the face of the forest's natural tendency towards fire suppression. Until such an hypothesis has been tested, any attempt based on data from historical fires to establish the existence of a fire cycle or a "natural fire return interval" is questionable. The application of sophisticated statistical techniques to provide a prediction of fire return may succeed only in discovering an artifact of the search itself and putting a

patina of numerical accuracy on a spurious set of numbers.

We would feel justified in speculating that the fire paradigm is malign if an examination of regeneration in the boreal forest organized to test the hypothesis we have put forward resulted in support for the existence of alternative ecological processes in the boreal forest. The current prevalence of the decay/cleansing by fire/regeneration hypothesis has had two impacts we find profoundly disturbing. The first is the espousal of the paradigm by forestry companies. For several decades now forest companies have defended their practices by claiming that they have an effect on the forest similar to that of a large-scale fire. The most disturbing aspect of this position is that as the fire paradigm has become more dominant, the public policies governing forest activity have tended to encourage forest removal and removal practices which are seen to mimic fire rather than restrict practices detrimental to the immediate maintenance of forest cover. Also, the prevalence of the paradigm has allowed both public and private suppliers of research funds to continue to justify self-serving research aimed at making forestry practices more closely resemble fire.

The second development which is particularly disturbing to us is that other analysts of the boreal forest, specifically those interested in wildlife, have begun to accept the fire paradigm as a given in explaining habitat change and species fluctuation and distribution. One close colleague in the wildlife area recently suggested that the future of wildlife diversity in Canada's boreal forest was dependent on finding a method of logging that closely mimicked fire! The authors of this paper were terrified by the fervour with which this ill-formed solution to a complex problem was supported.

Porcupine Hills, AB looking west. *Teresa Dolmar*

THE SASKATCHEWAN CONSERVATION DATA CENTRE: A BRIEF INTRODUCTION AND PROGRESS SUMMARY REPORT.

JAMES R. DUNCAN, Saskatchewan Conservation Data Centre, 3211 Albert Street, Regina, SK S4S 5W6

Saskatchewan Conservation Data Centre Overview:

In October 1991, the Saskatchewan government signed an agreement with the Nature Conservancy of Canada and the Nature Conservancy U.S.A. to develop a Conservation Data Centre for the province. In April 1992, four staff began setting up the Saskatchewan Conservation Data Centre (SKCDC). The SKCDC represents a comprehensive information management technology developed specifically to guide the conservation of biological diversity. Similar Data Centres have been established in all 50 U.S. states, 13 Latin American nations, as well as British Columbia, Manitoba, Ontario and Québec. As such, the SKCDC is a provincial node for an international network of permanent information-gathering institutions. This enables the synthesis of biological data on an ecological scale that transcends political jurisdictions.

Data on the location of rare and endangered species and plant communities are plotted on 1:50,000 scale topographic maps. Spatial information is also stored in an electronic form compatible with Geographic Information System applications. Information assembled and managed by the Data Centre focuses on: ecosystems and species, their biology, habitats, locations, conservation status and management needs; managed areas such as Provincial and National Parks, Wildlife Management Areas, watersheds; and data sources.

To implement a provincial policy of sustainable development while conserving biological diversity it is necessary to put sound biological data into a socio-economic context. The combination of biological and non-biological information assembled and organized in the database provides a decision support system which will enable the province to meet its conservation commitments.

Progress to Date:

- Over **2,000** element occurrences (specific locations of rare plants, animals, and plant communities) have been computerized into standardized data files and mapped.

- Information is computerized and available for:

  8,559 literature references
  3,383 species
  139 plant communities
  748 managed or protected areas

- Over **600** data requests fielded from:

56% Conservation and Research Groups

23% Provincial and Local Government Agencies

16% Corporations, Landowners & Consultants

5% Federal Agencies

Cooperative Research Projects:

- **Saskatchewan Biological Survey:** a 10-year strategy to systematically inventory Saskatchewan's natural biological diversity by ecological regions. Results will provide sound recommendations for protected areas planning and land management decisions.

- **Protected Areas Study:** inventory and map information on protected land designations & to assess the ecological representation.

- **Ecological Land Classification:** to develop a standardized ecological classification system for the province in cooperation with Environment Canada.

- **Canadian Council on Ecological Areas Grasslands Project:** to develop guidelines for determining ecological representation.

In addition, cooperative research and data exchanges are ongoing with the Canadian Parks Service, Central Surveys & Mapping, Canadian Wildlife Service, Ducks Unlimited, Prairie Farm Rehabilitation Agency, Regina Natural History Society, Royal Saskatchewan Museum, Saskatchewan Environment and Resource Management (Wildlife, Parks & Protected Areas, Policy & Partnerships, Fisheries, Sustainable Land Management), Saskatchewan Natural History Society, Saskatchewan Research Council, University of Regina, University of Saskatchewan and others.

The Saskatchewan Conservation Data Centre is indebted to numerous individuals willing to share information to further the conservation of Saskatchewan's biological heritage. We would especially like to recognize Vern Harms, Wayne Harris, Dale Hjertaas, Stuart and Mary Houston, Paul James, George Ledingham, Keith Roney, Karyn Scalise, Al Smith, and Frank Switzer for their exceptional generosity. Volunteers Martin Bailey, Jill Forrester, Tim Howie, Amy Jensen, and Robert Warnock have donated many hours of hard work.

For more information about the Saskatchewan Conservation Data Centre please contact one of the following staff:

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NOTES AND LETTERS

NORTHERN GOSHAWKS MOVE BACK SOUTH

C. STUART HOUSTON, 863 University Drive, Saskatoon SK S7N 0J8

A Northern Goshawk nest, a rare find in Saskatchewan, is both a thrill and a challenge. North of Shellbrook, about 1991, a pair was known to swoop down at dogs and people if they walked near the foot of the nest tree. Usually, a bander climbing to the nest suffers a number of forceful hits, either while ascending, at the nest, or only during the descent.

Probably the first goshawk banded and certainly the first recovered in North America was #202 406, banded by Harry L. Felt, at Findlater, Saskatchewan, on 4 August 1922. It was killed at Bostwick, Nebraska, 26 April 1926. The next six were banded in 1934-35; Bird Banding Notes 2(13):204 and 207, 1935, made the incorrect claim that the goshawk banded at Waukesha, Wisconsin, when it flew against the backdrop of a tennis court in hot pursuit of a Blue Jay, was the first ever banded in North America.

Most goshawk nests in Canada are, as Frank L. Beebe relates, restricted to coniferous or mixed forest.[2] The following sites are depicted as proven nest records in Alan R. Smith's *Atlas of Saskatchewan Birds*[5]. I have banded at three nests found near Elaine Lake by Rick Miller, Al Melnychuk and Wayne C. Harris in 1978: one with 3 young and a second with one young, both on 14 June, and another with 2 young on 23 June. The latter nest had a young dead on the ground, apparently blown out of the nest and killed on the ground by a coyote. In 1979 Merv Syroteuk and Brian Johns took us to a nest with three young, 45 feet above ground in a black poplar, north of Canwood, on 3 July. On 1 July 1992, Muriel Carlson and Lois Wooding directed us to a nest with one young 43 feet above ground in a jackpine, along the ski trail northeast of Duck Lake. All of these nests were in mixed forest in keeping with Beebe's predictions. The same holds for a nest found by Stan Shadick on 22 May 1971 on the Papikwan River near Smokey Burn in the Pasquia Hills. This nest was revisited the next year by Lynn Oliphant on 20 May and had only one downy young, about ten days old, present when Bob Rafuse visited on 24 June.

Before the days of white settlement, two oologists found Goshawk nests when they visited the parkland area of the territory of Assiniboia, within what is now eastern Saskatchewan, far south of any natural conifers. Walter Raine took a set of two eggs while visiting the Baines family at Crescent Lake, west of Saltcoats, on 24 May 1890.[4] The size and description of the eggs exclude any possibility of a Cooper's Hawk nest having been misidentified. Edward Arnold was shown a nest with two eggs, 8 feet above ground in a willow, near Fort Qu'Appelle on 28 May 1895.[1] At the time, the Common Raven was more common than the American Crow.

As patches of aspen forest were cleared and land was broken, the gos-

hawks and ravens appear to have retreated north to their expected habitat in the mixed forest. The remaining goshawk nests have been located farther south in pure aspen habitat, with no conifers near, contrary to Beebe's predictions. I first learned of recent nesting, in pure aspen stands in parkland, in 1981. Conservation Officer Bob Finley found a nest 30 feet above ground, in an aspen, on the farm of Clayton Robertson, just outside of the north boundary of the Red Pheasant Indian Reserve 10 miles west and one mile south of Baljennie. Two young were banded on 13 June. In 1982, goshawks built a nest in thick aspen forest five miles west and 1.5 miles south of Sonningdale; when visited by Bob Finley and me on 23 June it contained only an addled egg. Near Raymore, in 1985, a pair remained throughout summer, though no nest was located by Wayne Harris.[3] On 6 July 1984, Ken De Smet found a nest with 3 large young, ready to fledge, on the Canadian Wildlife Service quarter 3.5 miles south and 3.5 miles east of Rosthern.

In 1992, Muriel Carlson told me of a nest found by Tom and Margaret Terpstra in aspen bush near Edam. When Marc Bechard, Martin Gerard and I visited it on 18 June, Martin banded the three young and also the adult female, caught with a net as she swooped at him.

The first goshawk nest in the Yorkton area was found by Bev McLaren, in an aspen 11 miles west of Bredenbury and one mile north of Highway 15. Three young were out of the nest and learning to fly on 11 and 12 July 1992. After being told of the record by Warren Hjertaas, I viewed McLaren's videotapes; the eye-stripe made identification unmistakeable.

Barry Usselman located a goshawk nest about 26 feet above ground in an aspen 9.5 miles west of Sonningdale in 1996. Martin Stoffel informed me on 5 July 1997 that the pair had returned. Barry took us the next day. We knew the young were large and ready to fledge, so we took a crew of spotters and Dylan von Kuster as climber. While Dylan went up the tree, Barry, Pat Bulman, Sandra von Kuster and I, together with Martin and Regina Stoffel and their three children, spread out widely around the nest to observe where the young might fly. The older of the two male nestlings taxed Martin's powers of observation and his running speed through bush as the hawk took three consecutive flights of 250, 150 and 200 yards, before crouching inconspicuously on the ground in a power line clearing. The other flew a shorter distance and was easy to keep in sight. Both were banded and restored to the nest by Dylan. Barry Usselman tells of the 1996 nest chronology in the previous article (see *Blue Jay* 56:125 126).

1. ARNOLD, E. 1895. An outing in Assiniboia. *Oologist* 12:151.

2. BEEBE, F.L. 1974. Field studies of the Falconiformes of British Columbia. British Columbia Provincial Museum Occasional Paper # 17.

3. GOLLOP, J.B. 1985. Prairie province region. *American Birds* 39:315-317.

4. RAINE, W. 1892. Bird-nesting in North-west Canada. Hunter Rose, Toronto, p. 172.

5. SMITH, A.R. 1996. Atlas of Saskatchewan Birds. Saskatchewan Natural History Society Special Publication 22.

SNOW GOOSE SUCCESSFULLY COUNTERATTACKS BALD EAGLE

W.J. WALLEY, 222 Bossons Avenue, Dauphin, MB R7N 0R2

Although the Bald Eagle is well known as a predator of fish and as a scavenger, its habit of attacking waterfowl, including geese, is also well documented. This report cites a goose - eagle interaction with a different twist.

At mid-morning 17 October, 1992 in company with Claudette Fern Clyde, a one blue phase Snow Goose was spotted as it stood on a worked field some 400 m east of our vantage point in my vehicle. The bird was situated about 80 m south of the dike road along Edward's Creek approximately 1.5 km west of the creek estuary in the southwest corner of Lake Dauphin. The goose was assumed to be injured, possibly wounded by a hunter's shot, and left behind by the flock. Overcast, calm and mild conditions prevailed.

While observing with 7x binoculars, an immature Bald Eagle appeared further east at a considerable altitude and began a long gradual descent in the direction of the goose which, it became apparent, had been targeted. The raptor's speed, though steady, was not spectacular as it approached its quarry. Seconds before making contact with the goose, the eagle checked its descent changing its attitude of attack from an angular one to a hovering-vertical-drop directly toward the goose. Suddenly, the goose burst upward and engaged the eagle 5-6 m above the earth with its back vertical to the ground and its clawed feet thrust outward to meet the predator's outstretched legs and talons. The aerial skirmish, which involved frantically beating wings of both birds, was over in less than 3 seconds with the goose returning to the ground fully in control of its flight. The eagle flew upward with typical laboured wing-beats an estimated 150 m then flew off to the southwest before turning back toward the lake in a long arc. There was no indication that the attack would be repeated.

We then drove along the dike-road until opposite the goose where I proceeded toward it on foot. When within 50 m of it, the goose took wing flying powerfully to the southeast at a low angle a distance of 250m and disappeared over aspen woods.

It is not certain that the goose actually flew straight up to meet its attacker. There is some question that a goose is even capable of this. However, from our vantage point it certainly appeared to. On the other hand, had it been viewed from the south or north rather than from the west, we may have seen it rise at an angle or nearly so. Why did the eagle fail to take the goose? As an immature, it was possibly surprised by the counterattack. Its tentative approach to its intended prey - its slow gradual descent; hovering and settling-on-its-prey approach instead of a swooping-grasping attack, suggested inexperience on the part of the eagle, likely a juvenile as indicated by its very dark plumage. Did the aggressive behaviour on the part of the goose stem from its ability to sense the inexperience of the eagle and was it able to further sense that attacking the eagle was a better survival tactic than resorting to escape flight? Perhaps it didn't even see the eagle until the last

few seconds of the attack which may have been a factor in how it arose to meet its adversary.

1. BENNETT, R.S.JR. AND E.E. KLAAS. 1986. The Bald Eagle pursues and injures Snow Goose in flight. Raptor Research 20(2): 75-76.

2. BENT, A.C.1961. Life histories of North American birds of prey. Part One. Dover Publishing Co.

3. COOKE, F, R.K.ROSS, R.K.SCHMIDT, AND PAKULAK, A.J. 1975. Birds of the tundra biome at Cape Churchill and LaPeruse Bay. Canadian Field-Naturalist 89 (4): 413 - 422.

4. DEKKER, D. 1984 Migrations and foraging habits of Bald Eagles in east-central Alberta, 1964 - 1983. *Blue Jay* 42 (4): 199-205.

5. GERRARD, J.M. AND G.R.BORTOLOTTI. 1988. The Bald Eagle: haunts and habits of a wilderness monarch. A Smithsonian Nature Book. Western Producer Prairie Books, Saskatoon, Saskatchewan. 177pp.

6. KNOGHT, R.L., P.J. RANDOLPH, G.T.ALLEN L.S.YOUNG, AND W.J. WIGHEN. 1990. Diets of nesting Bald Eagles, *Haliaeetus leucocephalus*, in western Washington. Canadian Field-Naturalist 104 (4): 545-551.

7. MCILHERRY, E.A. 1932. The Blue Goose in its winter home. Auk 49: 279-306. (In J.M. Gerrard and G.T. Bortolotti 1988)

8.NERO, R.W. 1987, Additional records of Bald Eagle predation of waterfowl. Blue Jay 45 (1): 28-29

Black-capped chickadee - Pike Lake *Roy Joh*

A POSSIBLE CAROLINA WREN

RONALD R. HOOPER, Box 757, Fort Qu'Appelle, SK S0G 1S0

On November 25, 1997 Mrs. Florence Pearpoint saw a large wren at her bird feeder in Fort Qu'Appelle. It was larger than a House Wren; buff coloured underneath, and with a pale line above the eye. It was seen so frequently that day that she wasn't sure if it was the same bird, or if there were more than one of them.

She checked in her bird book and decided that the bird must be a Carolina Wren. Not knowing the rarity of this species in western Canada, she did not report it to any other bird-watchers. Between Christmas and New Years (in December, 1997) one of these birds came to the feeder one more time. Mrs. Pearpoint casually mentioned her sighting to Lorne Rowell later, but unfortunately the bird was not noticed since.

The Carolina Wren is a permanent resident in the south-eastern United States. In the fall some of them move northward and populate new areas, and establish themselves as far north as southern Ontario. They live a few months or years in these areas until they are killed off by severe winters, and the area must be repopulated by later northward movements of them. The Carolina Wren occasionally wanders north westward. There are two fall records of it for southern Manitoba, and one for Lethbridge, Alberta. We have not heard of any previous reports for Saskatchewan.

The mild fall and winter of 1997, with no snow remaining on the ground until after New Year's Day of 1998 would be a very likely time for a Carolina Wren to wander into our area.

High Bush Cranberry *A. Clare Hume*

NATURE LIBRARY

SPRING AGAIN AND OTHER POEMS

ROBERT NERO. 1998. Published by Natural Heritage/Natural History Inc., P.O. Box 95, Postal Station O, Toronto, ON M4A 2M8. 82pp. $9.95

Older members of the Saskatchewan Natural History Society (now Nature Saskatchewan) will have fond memories of Bob Nero, the knowledgeable and inspirational young American, who moved to Regina in 1955 after graduating from the University of Wisconsin. Before moving to Winnipeg, where he became Senior Ecologist with the Wildlife Branch, Department of Natural Resources, Bob was employed for a number of years at the Saskatchewan Museum of Natural History and later at the University of Regina. A North American authority on both the Red-winged Blackbird and the Great Gray Owl, Bob has authored numerous technical papers and several major works, among them *The Great Gray Owl - phantom of the northern forest,* published by the Smithsonian Institute. But he has a gift, relatively rare among scientists; he also knows how to communicate his observations and deepest feelings in lucid prose and incisive poetry.

His first book of poetry, *Woman by the Shore and other poems*, appeared in 1990. It was followed in 1993 by *The Mulch Pile and other poems.* In 1994. Bob returned to prose. In *Lady Grayl, Owl with a Mission*, Bob tells the fascinating story of the baby Great Gray Owl which he rescued and raised to maturity. Bob and Lady Grayl (who will soon be 14 years old) have visited countless schools and public gatherings all over Manitoba, and were our special guests at the fortieth anniversary meeting of the Saskatoon Nature Society in September 1995.

Spring Again and other poems is Bob Nero's most recent publishing venture. In keeping with his earlier works, most of the poems are about some aspect of nature, closely observed. But his wife Ruth figures more prominently in these pages, and many of his best poems are tributes to the woman with whom he has shared his life. Has anyone expressed his love more feelingly than bob in the little poem "Love"?

When finally
I am an old man
and tying my shoelaces
is a daily triumph
I shall think of you
and tremble
with the memory
of our touching
forever glad
that we took time
to love.

I'd like to call Bob, "The poet of moments", or should I say, "The momentous poet"? As in his previously published nature poems, he is at his best describing a precious moment: a black butterfly clinging to a screen; Purple Martins flying in the wind before a storm; fireflies in the garden; an early Mourning Dove's first mellow song; Buster, the family dog, floundering in three feet of new snow. Bob's poems shouldn't be read all at once. Savour them; read two or three at a sitting, perhaps outdoors in your garden. Recognize (jealously perhaps) his gift at recreating moments you too may have experienced but

couldn't express in words.

Readers should not be surprised at the breadth of this nature poet's interests and concerns. He writes on subjects as varied as the relationship between man and wife ("Revelations Of Ruth"), the change of seasons ("Light Trick"), aging ("New Leaves", "Winnipeg Morning"), household routine ("Agendas"), the child within us ("Possible Showers"), and nature's harshness seen in perspective ("Change of Heart"). Expect, too, traces of puckish humour. Lying on his back to watch martins high overhead, he wonders, "Will our neighbours think I've died?" A surprising number of this ornithologist's poems are about insects. In addition to the fireflies and butterfly mentioned above, his subjects include daddy-long-legs, carrion beetles, cabbage butterflies and ants.

As in any collection of poems, the reader will pick and choose among the offerings. I find a few of them prosaic, unnecessarily didactic, perhaps lacking the spark of creativity. But I have turned again and again to those I cherish. This little book, like the others that preceded it, contains a wealth of observed detail, feeling and memory. It is indeed a precious addition to Nero's library of "moments."

All of Bob Nero's poetry books and *Lady Grayl, Owl with a Mission* are available from his publisher, Natural Heritage/ Natural History Inc.

Reviewed by *J. Frank Roy*, 650 Costigan Way, Saskatoon, Saskatchewan S7J 3R2

Caribou at Salters Lake *M.A.Gollop*

WHALES

DAVID JONES. 1998. Whitecap Books, Vancouver/Toronto, vi+110 pp., 64 Color photos. $24.95

"Whales," written by David Jones is a coffee table book, filled with exciting and often close-up photos of some of the world's largest whales. There are sixty-four of the best whale photos in this book, all taken by whale watchers in the field. In contrast, the text, which is well written and easy to read is more or less a modern summary of the facts about whale biology.

David starts by telling us all kinds of ways people have killed whales in the past and why they did these insensitive acts to the most interesting sea mammals. Fortunately, David didn't choose to accompany this first chapter with gory photos.

The rest of the book is about modern up to date whale biology and in this book you will learn something new. Each photo in the book is accompanied with a lengthy caption which usually tells the reader the name and where the photo was taken, and a little bit of whale biology.

"Whales" is not much of a field guide. David doesn't tell us where, when and how to see and identify whales. But David did do his research on what is known about whale biology and gives us this information in easy to read and understandable text.

On the down side: It was apparent from the text that he wasn't there with the whales in the photos. The text to the photos was more research than experience. There was little to no story line relating his own experience and sometimes he either couldn't or wouldn't identify the whales in the photos, so his comments were about generalities of whale biology rather than about the photos.

Nevertheless, I thoroughly enjoyed the up-to-date biology information and would recommend this book to anyone to save them the library search that David did. As a coffee table book the photos are really great, and well worth the cost of the book.

Reviewed by *David Lawley*, Cape Breton, Nova Scotia (David is the author of "A Guide to Whale Watching in the Maritimes". Nimbus Publishing Ltd.)

A hawk has 1.5 million visual cells compared to 200,000 cells for a human in the same area of the retina.

The eggs of a Calliope Hummingbird average 12x8 mm compared to Trumpeter Swan's egg of 111x72 mm.

UNUSUAL BAT BEHAVIOUR

GERALD A. WILDE, Hinton, AB

On Friday August 2nd, 1996 near Flotten Lake in Meadow Lake Provincial Park I was spray painting an outdoor propane tank. It was a very warm day (30+ degrees C.) with no noticeable wind. The time was approximately 3:00pm. I was using a Tremclad paint in a small pressurized container. I had been spraying for a few minutes and the container was nearly empty.

A little brown bat flew into the vicinity and fluttered around my spraying can and them landed on the propane tank at the site of my latest application. I was amazed and stopped spraying, whereupon the bat left the tank, circled the area then disappeared into the adjacent spruce/pine forest. My first reaction was that there was something wrong with the bat, and perhaps I should make an attempt at capturing it as a possible rabies candidate. However the bat was no longer visible and I returned to the process of painting the tank. Immediately on starting application a second little brown bat approached from under the eaves of a nearby building. This bat also flew directly to the spray can and made attempts at landing on the can, whereby I stopped spraying and the second bat then flew off into the adjacent forest. I now suspected the noise from the spray can was attracting the bats and although I continued to spray the tank no more bats came.

There were two different bats that were enticed to come out in broad daylight by the noise of the spray can. They came directly to the can and attempted to land on it. It appeared that the noise of the can was only attractive for a short period of time, probably resulting from a combination of the pressure in the can and the material of the propane tank. Although there are numerous bats in the vicianity and throughout the summer I have used a variety of spray paints, but this was the only incidence of this kind that I have noted.

(Editor's note: We were saddened to learn of the early death of Gerald Wilde. He was a naturalist who, through his passion, influenced others to care about nature. The above note was found among his papers ready to be sent to the Blue Jay.)

The Rufous and Calliope Hummingbirds both breed in Alberta. The Rufous has been recorded in neighbouring Saskatchewan 21 times compared to only once for the Calliope.

IN MEMORIUM Gerald A. Wilde

By Heather Wilde

Gerald Anthony Wilde was born on January 11, 1945 in Cudworth, Saskatchewan where he grew up. After graduating with a diploma in the Natural Resources program at Kelsey College in Saskatoon, he became the Conservation Officer in Meadow Lake, Saskatchewan for two years. It was when he decided to return to University in 1967 that he met Heather Ann Lussier. They were married in 1969.

Gerald obtained a degree in Biology in 1970 and became a naturalist with the Royal Museum of Saskatchewan. Many hearts, young and old, were touched by Gerald's knowledge and his sincere love of wildlife as he shared his excitement in discovering new bird's nests, the fresh blossoms of the prairie flowers and the many small creatures who made their home at the Condie Nature Refuge.

A year later, Gerald studied large mammals as a Wildlife Technician with the Canadian Wildlife Service in Edmonton. During the summer, he investigated Grizzly Bear activity in the National Parks, and then moved on to the MacKenzie Pipe Line study for the winter months. This work gave him a marvellous opportunity to discover new pieces to understand the big picture, a personal goal that he worked toward with a lifetime of discoveries.

In 1972, Gerald became a Wildlife Instructor at the Hinton Forest Technology School (now the Environmental Training Centre), a position he held for 23 years. He never tired of dragging family, friends, colleagues and students along with him up mountain trails, into cold running streams, through thick under brush and deep into underground caves to see, feel, hear, smell and be part of the wild outdoors he loved so much. His immense sense of curiosity and his unyielding, internal drive to test, to risk, to learn and to thirst for new adventures was the gift that allowed the rest of us to have lived such full lives with him.

A consistent presence in the wildlife field in West-central Alberta, Gerald was a free thinker. He became a thorn in the side of the government and the Forest industry, asking hard questions and demanding straight answers. He loved to trap, and became a nationally renowned trapping instructor. In 1987, Gerald took a year's sabbatical and became the Conservation / Education Coordinator for the Fur Institute of Canada, travelling from St. John's, Newfoundland to Bella Bella, British Columbia coordinating many aspects of the fur industry and promoting Humane Trapping methods.

Gerald and Heather raised two sons, Kristoffer and Jonathan. He taught them to love and respect nature; to use common sense; to reach for their goals; to be responsible for their wants, their needs and their deeds; to be accountable; to be loving and giving, to be spiritual, to have faith in God, to be at peace. He often recited this small poem, and lived his life by it.

I have only just a minute,
Only sixty seconds in it
Forced upon me can't refuse it
Didn't seek it didn't choose it
But it's up to me to use it
I must suffer if I lose it
Give account if I abuse it,
Just a tiny little minute
But eternity is in it.

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